Report to Strategic Priorities and Policy Committee

To: **Chair and Members**
Strategic Priorities and Policy Committee
From: **Kelly Scherr, P.Eng., MBA, FEC**
Deputy City Manager, Environment & Infrastructure
Subject: **2022 Climate Emergency Action Plan Progress Report**
Date: **May 30, 2023**

Recommendation

That, on the recommendation of the Deputy City Manager, Environment & Infrastructure, this report **BE RECEIVED** for information.

Executive Summary

In April 2022, Municipal Council unanimously approved the Climate Emergency Action Plan (CEAP) with the goals of reducing community-wide emissions to net-zero by 2050, improving London's resilience to climate change impacts and ensuring that everyone in London is able to participate in working to reduce emissions and adapting to change. This Strategic Priorities and Policy Committee (SPPC) report and the 2022 CEAP Progress Report (Appendix A, also known as the community report) covers the period from May to December 2022 (eight months) and introduces some highlights in 2023.

Reporting progress on CEAP, by measuring where possible and following the activities of others where measurements are not possible, occurs by examining five key outcome areas:

1. CEAP Actions by Area of Focus
2. Climate Actions by Others in the Community (and Interested Parties)
3. Climate Actions by Other Levels of Government
4. Greenhouse Gas Emissions
5. Weather Trends and Impacts

1. CEAP Actions by Area of Focus
To set the stage for the successful implementation of the CEAP, 17 foundational actions were identified in the February 8, 2022 SPPC report. Each of the 17 foundational actions have been initiated since the CEAP's approval and ongoing efforts for implementing and completing those actions continue.

The CEAP includes 59 Categories of Actions and contains 200 individual actions, ranging from basic to complex, across the ten Areas of Focus. Some actions in the CEAP address specific deliverables or achievements that can be tied to a timeline while other actions require ongoing efforts and do not have a specific targeted end date.

Of the 200 actions, 57% (113) have a Timeline and 43% (87) are considered Ongoing Actions. Of the 74 Timeline Actions schedule to start in 2022, 65 (88%) have been started. Similarly, of the 62 Ongoing Actions schedule to start in 2022, 58 (94%) have been started.

<u>Use of the Climate Lens Framework on Corporate Projects and Programs</u>
Creation and implementation of the City's Climate Lens Framework has advanced since the approval of the CEAP, with many work groups within different City of London Service Areas using the approach to embed climate considerations into decision-making. Some notable projects and initiatives where the Climate Lens Framework was or is actively being used include the areas of road infrastructure, landfill gas management, wastewater treatment Biosolids Management Master Plan, Corporate Master Accommodation and Alternative Work Strategy, development of the Mobility Master Plan, ReThink Zoning, and a climate and environmental impact summary

template. The inclusion of the Climate Lens Framework in future committee reports will be completed soon as well, making it easier to identify where it has been applied and the outcomes it generated.

Indicators of Progress Towards Expected Results
The CEAP Area of Focus Workplans reference a set of over 100 potential indicators of progress that are intended to evolve throughout the CEAP implementation process and be used to characterize the progress towards CEAP goals. A subset of 66 of the initial 100 indicators represent the baseline data that is currently available to measure progress.

Early Activities in 2023 and Upcoming Activities
In addition to the activities detailed in the 2022 CEAP Progress Report, activities have continued in early 2023 and numerous are upcoming. This SPPC report highlights five in the first few months of 2023 and more than ten for later in the year.

In Summary
Just over 90% of the CEAP's 2022 actions, both Timeline and Ongoing Actions, have been initiated by City staff or by organizations in London. Over 70% of the 200 CEAP actions have been initiated.

2. Climate Actions by Others in the Community

Achieving the goals of the CEAP requires effort from all sectors in London and is influenced by actions of others outside London. Several recent examples in the Businesses and Institutions sectors and Households, Individuals and Community Groups are listed in this SPPC report and the community report (Appendix A).

There are currently limited measures that illustrate if activity increased in 2022. What is being reported by organizations and/or shared through other communications methods (e.g., social media, websites, reporting by media, etc.) would suggest there is an increase in activity in London by other organizations.

3. Climate Actions by Other Levels of Government

Actions taken at the provincial and federal government levels directly or indirectly influence climate change actions and greenhouse gas emission in London. In 2022, more than 15 major actions are noted in this SPPC report and the community report for other levels of government (Appendix A). At the international level, details and other sources can be found in numerous locations including the United Nations.

Actions on climate change are occurring at both levels of government in Canada and around the world. Actions vary widely across Canada. Concerns that are often raised include are the actions moving quickly enough, do the actions have enough funding and are the problems being addressed. Measuring progress in Ontario and Canada focuses primarily on greenhouse gas reduction numbers which are available on government websites.

4. Greenhouse Gas Emissions

Corporate Energy-Related Emissions
Current corporate energy-related emissions have been influenced by the existing 2019-2023 Corporate Energy Conservation and Demand Management (CDM) Plan. In 2022, corporate energy-related greenhouse gas emissions were 18,900 tonnes of equivalent carbon dioxide. This is 58 per cent lower compared to 2007, the baseline year for measuring progress. Corporate greenhouse gas emissions continue to track below the trend line to achieve future reduction targets.

Compared to recent years, there has been an increase in Corporate greenhouse generation primarily due to Ontario's electricity grid relying more on natural gas use in 2022. Given that electricity represents 57 per cent of the corporate energy use, changes in Ontario's electricity grid will have a big impact on corporate energy-related emissions.

Positive corporate greenhouse gas emission trends and occurrences in 2022 include:
- total energy use was down 5.3% from 2018 levels, exceeding the 2019-2023 Corporate Energy CDM Plan goals;
- Energy use by wastewater treatment operations was down 12% from 2018 levels; and
- Diesel fuel consumption decreased by 11% from 2018 levels, due in part to switching six solid waste packers to CNG.

Negative corporate greenhouse gas emission trends and occurrences in 2022 include:
- Greenhouse gas emissions intensity of Ontario's electricity grid has increased by over 40% from 2018 levels which increase corporate emissions;
- Energy used for water distribution has increased by 9% from 2018 levels due to equipment issues at the Southeast Reservoir and Pumping Station (SERPS) that have since been repaired; and
- Increased gasoline usage by 14% from 2018 levels due to COVID-19 health requirements that created the need for additional work vehicles (e.g., pickup trucks).

Community-wide Emissions

Total greenhouse gas emissions in 2022 were 2.96 million tonnes of equivalent carbon dioxide, with half of the emissions coming from personal transportation and energy use at home. This is 24 per cent lower than 2005 levels, the baseline for measuring progress. When compared to 2021 which was the highest greenhouse gas emission reduction year to date, 2022 saw an increase primarily due to colder winter weather increasing natural gas use for building heat, combined with Ontario's electricity grid relying more on natural gas use.

Even with the significant effect of COVID-19 on GHG emissions in the community, emissions in 2022 were above the trendline needed to meet London's new science-based targets, notably the 2030 target for a 55 per cent reduction from 2005 levels.

Positive community greenhouse gas emission trends and occurrences in 2022 include:
- Residential energy use per person has seen consistent reductions;
- Average distance travelled by bike increased;
- Number of hybrid and electric vehicles in London has increased;
- Retail sales of fuel per person in 2022 were only 2.5% higher than 2021 and still about 20% below pre-pandemic levels;
- Installed solar power generation capacity has increased;
- Industrial, commercial, and institutional energy use per person has seen consistent reductions; and
- Energy productivity ($ GDP per unit energy) increased.

Negative community greenhouse gas emission trends and occurrences in 2022 include:
- Greenhouse gas emissions intensity of Ontario's electricity grid has increased by over 40% from 2018 levels which increase community emissions;
- Market share sales of larger personal vehicles (e.g., pickups and SUVs) has increased;
- Electric vehicle adoption rate in Ontario was lower than Canada's overall rate; and
- Electric vehicle adoption rate in London was lower than Ontario's overall rate.

Consumption-related Emissions

In 2019, the City of London started highlighting the importance of consumption-related greenhouse gas emissions. These are defined as all the greenhouse gas emissions associated with providing goods and services to Londoners, including those that take place outside London's boundaries. A good example would be the emissions associated with food as the majority comes from outside London. There are emissions associated with growing crops, feeding animals, preparing food products for market, and transporting these to market. The 2022 CEAP Progress Report furthers the discussion for the purpose raising awareness about the importance of all emissions, locally and globally. New information in is presented in progress report based on an approach being used by a growing number of Canadian municipalities.

5. Weather Trends and Impacts

Documenting weather events and trends that will eventually influence the evolution of London's climate is part of Areas of Focus 8, Adapting and Making London More Resilient, and an important foundation of the development of the Climate Change Adaptation Discussion Primer Plan. Wind, rain and temperature events are examples of how severe weather will impact the ability of London to adapt and become more resilient.

Locally, the most significant weather event was the May 2022 wind storm, termed a "derecho" that included two tornadoes in London. The impacts were observed throughout the city, resulting in downed trees and damage to buidings.

Canada-wide and world-wide examples of severe weather highlighted the need for cities to prepare for and become more resilient with respect to a changing climate.

Financial Impact/Considerations

Similar to what was reported when the CEAP was approved in 2022, investment in climate action over the full term of the CEAP (to 2050) by the City, businesses and residents is anticipated to be significant. Investments must also come from other levels of government to assist local government. Some of these investments are anticipated to align with and sometimes replace planned future spending. In some cases, investments to achieve CEAP goals may result in opportunities for net savings, though additional up-front capital costs may be required to realize lower lifetime asset costs.

Several short term and longer-term activities are underway at the City including:

- The launch of a project for energy, emissions, land-use, and financial scenario modelling to help map possible futures to determine how to reduce emissions, create jobs, and optimize land use to create equitable, decarbonized, healthy communities;
- The launch of a project to review and advance City staff estimates for reaching net-zero emissions for Corporate assets (e.g., fleet, facilities, street lights, wastewater, water, landfill);
- Work on the City's Corporate Assessment Management update including the estimated expenditures associated with climate change and City assets;
- Further refining the order of magnitude costing included in Council's 2023-2027 Strategic Plan and then incorporating this into the 2024-2027 Multi-Year Budget process;
- Preliminary evaluation of carbon accounting/budgeting options for potential future implementation; and
- The creation of Climate Change Investment and Implementation Plan which plans out potential investments and funding strategies over multiple multi-year budgets, including 10 and/or 20 years capital plans.

Linkage to the Corporate Strategic Plan

Municipal Council continues to recognize the importance of climate change mitigation, climate change adaptation, sustainable energy use, related environmental issues and the need for a more sustainable and resilient city in the development of its 2023-2027 Strategic Plan for the City of London. Specifically, London's efforts in both climate change mitigation and adaptation address these areas of the Strategic Plan, at one level or another:

- Reconciliation, Equity, Accessibility and Inclusion
- Housing and Homelessness
- Economic Growth, Culture, and Prosperity
- Mobility and Transportation
- Wellbeing and Safety
- Climate Action and Sustainable Growth
- Well-Run City

Analysis

1.0 Background Information

The Climate Emergency Action Plan (CEAP) is a community-wide plan that was unanimously approved by Council in April 2022 following the declaration of a climate emergency in 2019. The CEAP sets out actions to drive progress towards these goals:

- Net-zero community greenhouse gas (GHG) emissions by 2050;
- Improved resilience to climate change impacts; and
- Bring everyone along (e.g., individuals, households, businesses, neighbourhoods).

The implementation of the CEAP is guided by milestone greenhouse gas emission targets for both London as a whole and the Corporation of the City of London:

- For London as a whole (community-wide):
  - 55 per cent below 2005 levels by 2030;
  - 65 per cent below 2005 levels by 2035;
  - 75 per cent below 2005 levels by 2040; and
  - Net-zero emissions by 2050.

- For the Corporation of the City of London:
  - 65 per cent below 2007 levels by 2030;
  - 75 per cent below 2007 levels by 2035;
  - 90 per cent below 2007 levels by 2040; and
  - Net-zero emissions by 2045.

The implementation of the CEAP is intended to be a whole community effort, with actions identified for the City, the community, businesses and institutions, and leaders throughout and near London.

1.1 Previous Reports Related to this Matter

Relevant reports that can be found at www.london.ca under Council meetings include:

- April 5, 2022, Overview of Engagement and Feedback on Draft Climate Emergency Action Plan, Report to the Strategic Priorities and Policy Committee (SPPC)
- February 8, 2022, Draft Climate Emergency Action Plan Report to the SPPC
- August 31, 2021, Outcome of Climate Lens Process Applied to Waste Management Programs and Projects to the Civic Works Committee (CWC)
- August 31, 2021, Outcome of Climate Lens Screening Applied to Major Transportation Projects to CWC
- April 27, 2021, Update – Development of the Climate Emergency Action Plan to the SPPC
- August 11, 2020, Climate Emergency Action Plan Update Report to the SPPC
- November 26, 2019, Climate Change Emergency Update Report to the SPPC
- April 23, 2019, Climate Emergency Declared at Municipal Council

2.0 Discussion and Considerations

The CEAP was unanimously approved in April 2022. This SPPC report and the 2022 CEAP Progress Report to the community cover the period from May to December 2022 (eight months) and introduces some highlights in 2023. Funding and resources for implementing the CEAP was based on approved budgets for 2022 and 2023. It was recognized that several existing approved projects and programs were able to proceed, while other initiatives need to wait until funding and resources could be considered as part of the 2024-2027 Multi-Year Budget deliberations. No new or additional budget or increased resources were assigned in 2022 or 2023 to CEAP actions.

Reporting progress on the CEAP, by measuring where possible and following the activities of others where measurements are not possible, occurs by examining five key outcome areas (Table 1).

Table 1: Reporting Progress on CEAP

Progress Reporting Outcome Area	Subset of Outcome Area
1. CEAP Actions by Area of Focus	• Actions identified in CEAP • Indicators of progress towards 2030 Expected Results
2. Climate Actions by Others in the Community (and Interested Parties)	• Business and institutional sectors • Individuals, households and community groups • Others nearby
3. Climate Actions by Other Levels of Government	• Provincial • Federal • International
4. Greenhouse Gas Emissions	• Corporate greenhouse gas emissions • Community-wide greenhouse gas emissions
5. Weather Trends and Impacts	• London and area • Canada • Global

The progress reporting areas on Table 1 are addressed in subsequent sections of this SPPC report with further details provided in the community report - 2022 CEAP Progress Report – contained in Appendix A.

2.1 CEAP Actions by Areas of Focus

To set the stage for the successful implementation of the CEAP, 17 foundational actions were identified in the February 8, 2022 SPPC report. Foundational actions were scheduled for implementation in 2022 or 2023. Each of the 17 foundational actions have been initiated since the CEAP's approval and ongoing efforts for implementing and completing those actions continue (Table 2).

Table 2: Foundational Actions – Status of Implementation

Foundational Actions	Total Actions	Actions Started	Ongoing Actions	Actions Complete
Actions with defined timelines	13	13 (100%)	N/A	7 (54%)
Actions requiring ongoing effort	4	4 (100%)	4 (100%)	N/A
Total	17	17 (100%)		

In addition the foundational actions, the CEAP includes 59 Categories of Actions and contains 200 individual actions, ranging from basic to complex, across the ten Areas of Focus. A breakdown of the type and progress on actions within each Area of Focus are included in the Tables 3, 4 and 5. Actions were scheduled to generally start between 2022 and 2024.

Some actions in the CEAP address specific deliverables or achievements that can be tied to a timeline (e.g., Transforming Buildings and Development's Action 2.a. "Reduce or eliminate parking minimums within the Zoning by-law") while other actions require ongoing efforts and do not have a specific targeted end date (e.g., Transforming Transportation and Mobility's Action 2.c. "Continue to Support the Active and Safe Routes to School Program"). Table 3 differentiates between these two types of actions and categorize them as "timeline" actions and "ongoing" actions. Of the 200 actions, 57% (113) have a Timeline and 43% (87) are considered Ongoing Actions.

Table 3: Area of Focus Workplan Actions Identified as Timeline or Ongoing

Area of Focus	Total Actions	Timeline Actions	Ongoing Actions
1. Engaging, Inspiring and Learning from People	9	2	7
2. Taking Action Now (Household Actions)	18	6	12
3. Transforming Buildings and Development	22	19	3
4. Transforming Transportation and Mobility	30	22	8
5. Transforming Consumption and Waste as Part of the Circular Economy	21	19	2
6. Implementing Natural and Engineered Climate Solutions and Carbon Capture	15	7	8
7. Demonstrating Leadership in Municipal Processes and Collaborations	44	24	20
8. Adapting and Making London More Resilient	9	4	5
9. Advancing Knowledge, Research and Innovation	9	8	1
10. Measuring, Monitoring and Providing Feedback	23	2	21
Total	**200**	**113**	**87**

The number of Timeline Actions included in each Area of Focus Workplan with a 2022 start year and the implementation status of those actions are listed in Table 4. Of the 74 Timeline Actions scheduled to start in 2022, 65 (88%) have been started. In addition to the 2022 Timeline Actions that were started, an additional 14 Timeline Actions scheduled for 2023 have been started. As of April 2023, 3 (4%) have been completed.

Table 4: 2022 Timeline Actions – Status of Implementation

Area of Focus	Timeline Actions	Actions Started	Actions Complete
1. Engaging, Inspiring and Learning from People	2	2 (100%)	0 (0%)
2. Taking Action Now (Household Actions)	5	5 (100%)	0 (0%)
3. Transforming Buildings and Development	14	11 (79%)	1 (7%)
4. Transforming Transportation and Mobility	19	16 (82%)	1 (6%)
5. Transforming Consumption and Waste as Part of the Circular Economy	15	15 (100%)	0 (0%)
6. Implementing Natural and Engineered Climate Solutions and Carbon Capture	5	2 (40%)	0 (0%)
7. Demonstrating Leadership in Municipal Processes and Collaborations	3	3 (100%)	0 (0%)
8. Adapting and Making London More Resilient	3	3 (100%)	0 (0%)
9. Advancing Knowledge, Research and Innovation	7	7 (100%)	1 (14%)
10. Measuring, Monitoring and Providing Feedback	1	1 (100%)	0 (0%)
Total	**74**	**65 (88%)**	**3 (4%)**

Note: 27 Timeline Actions are scheduled to start in 2023 and 12 more in 2024.

Those actions not started in 2022 will be prioritized in 2023 or 2024 based on the results of implementation planning and subsequent allocation of funding and/or resources to support the actions.

The number of Ongoing Actions included in each Area of Focus Workplan with a 2022 start year and the implementation status of those actions are listed in Table 5. Of the 62 Ongoing Actions scheduled to start in 2022, 58 (94%) have been started. In addition to the 2022 Ongoing Actions that were started, an additional six Ongoing Actions scheduled for 2023 have been started.

Table 5: 2022 Ongoing Actions – Status of Implementation

Area of Focus	Ongoing Actions	Actions Started
1. Engaging, Inspiring and Learning from People	6	6 (100%)
2. Taking Action Now (Household Actions)	12	11 (92%)
3. Transforming Buildings and Development	2	2 (100%)
4. Transforming Transportation and Mobility	8	8 (100%)
5. Transforming Consumption and Waste as Part of the Circular Economy	2	2 (100%)
6. Implementing Natural and Engineered Climate Solutions and Carbon Capture	5	5 (100%)
7. Demonstrating Leadership in Municipal Processes and Collaborations	12	10 (83%)
8. Adapting and Making London More Resilient	2	2 (100%)
9. Advancing Knowledge, Research and Innovation	1	1 (100%)
10. Measuring, Monitoring and Providing Feedback	12	11 (92%)
Total	**62**	**58 (94%)**

Note: 13 Ongoing Actions are scheduled to start in 2023 and 12 more in 2024.

As with the Timeline Actions, any Ongoing Actions that were not started in 2022 will be adjusted to a new expected start year in line with the allocation of funding and/or resources required to support the actions.

In summary, just over 90% of the CEAP's 2022 actions, both Timeline and Ongoing Actions, have been initiated by staff throughout the Corporation or by organizations in London. Over 70% of the 200 CEAP actions have been initiated. Engagement with staff, external partners and interested parties will continue in 2023 and beyond to prioritize, resource and ultimately initiate and progress the remaining actions.

A detailed summary of CEAP actions status and progress, including specific examples for each Area of Focus, is included in the attached 2022 CEAP Progress Report (Appendix A).

2.1.1 Use of the Climate Lens Framework on Corporate Projects and Programs

Creation and implementation of the City's Climate Lens Framework has advanced since the approval of the CEAP, with many work groups within different City of London Service Areas using the approach to embed climate considerations into decision-making. Some notable projects and initiatives where the Climate Lens Framework was or is actively being used include:

- Several road infrastructure projects, including the Windermere Road Improvements Environmental Assessment, the Adelaide Street North Environmental Assessment, and the funded sections of the Rapid Transit system.

- Evaluation of management options for source separated organics alongside landfill gas capture and utilization options for London's W12A landfill.

- Wastewater Treatment Operation's Biosolids Management Master Planning exercise is nearing completion with climate impacts and the reduction of greenhouse gas emissions prioritized as key decision criteria. This effort includes the evaluation of potential management options, the relation of those options to other City services (e.g., waste management, source separated organics management), and the evaluation and minimization of emissions and climate risks.

- Advancement of the City's Corporate Master Accommodation Plan and Alternative Work Strategy. These projects are both underway and include climate lens input to ensure planning and evaluation processes account for climate change considerations.

- The Mobility Master Plan includes climate lens input throughout the process and engagement efforts with Londoners have included direct connections to the CEAP.

- ReThink Zoning efforts to date have included the consideration of climate change issues to ensure that City climate action directions and commitments are reflected in the new zoning by-law.

- A climate and environmental impact summary template has been developed for inclusion in Planning and Environment Committee reports by Planning and Economic Development staff tasked with the review of development applications. This step is the first towards applying a climate lens to development applications and the process is intended to be extended to the Subdivision Approvals process next.

- Standard approaches and language for reflecting the use of the Climate Lens Framework in all Committee reports has been developed and are currently being tested and reviewed by staff.

In addition to the internal use of the Climate Lens Framework by City staff, representatives from other municipalities across Canada have reached out to learn about the process and how it may be used to inform similar processes in their jurisdictions. Outreach, discussions and information exchanges have occurred with representatives from Peterborough, Windsor, Kelowna, Sudbury, Edmonton, Owen Sound, and others. Furthermore, dissemination of information and training on London's Climate Lens Framework has occurred to enable peer learning through events or meetings led by the Clean Air Partnership and the Regional Public Works Commissioners of Ontario.

Additional efforts and resources are either underway or planned to fully evolve the Climate Lens Framework into an ongoing enterprise-wide program.

2.1.2 Indicators of Progress Towards Expected Results

The CEAP Area of Focus Workplans reference a set of over 100 potential indicators of progress that are intended to evolve throughout the CEAP implementation process and be used to characterize the progress towards CEAP goals. A subset of 66 of the initial 100 indicators represent the baseline data that is currently available to measure progress. In addition to the potential indicators included in the CEAP, measures that have been historically reported in the City's annual Community and Corporate GHG emissions reports are also now being reported as part of CEAP Progress Reporting. These are provided in 2022 CEAP Progress Report (Appendix A).

Collecting accurate data to support some Areas of Focus and Expected Results can be difficult and resource intensive. One such example is the collection of accurate data to determine the annual carbon sequestration in London, which is the process of capturing and storing atmospheric carbon dioxide. While it would be ideal to have a highly detailed inventory of carbon sequestration capacity of all land in London to measure year-over-year progress toward achieving net-zero emissions, this would be costly.

Alternative methods other than annual individual property assessment for sequestration capacity in vegetation, soil and other sources by a specialist(s) are currently being evaluated to determine the optimal data collection and/or estimation method.

Many existing City data collection systems can be relatively easily modified to capture new data that will inform CEAP progress. Work has started to incorporate key CEAP data into changes to internal Planning and Economic Development systems triggered by Bill 23 data and process requirements. The City's property information database system (AMANDA) and the processes by which data is added to the system through development and redevelopment activities are being modified to include data relevant to tracking climate action performance. Examples of this data include the number of net-zero and net-zero ready buildings being constructed (or retrofit), the units per hectare density of residential units in greenfield development, and the utilization of mass timber and/or low-carbon concrete in building construction.

Many of these indicators of progress have also been shared with the London Community Foundation for use on the Vital Signs Data Hub.

In future CEAP reporting, analysis of these data and their year-over-year trends will be possible to examine the level of progress that city-wide climate action efforts are achieving. In addition, new indicators will be added to support measuring those Expected Results that are currently underrepresented by quantitative data.

2.1.3 Early Activities in 2023

In addition to the activities detailed in the 2022 CEAP Progress Report, activities have continued in early 2023 with the following additional items of note advancing:

- Council's 2023-2027 Strategic Plan was approved in April 2023. It includes an entire area of focus called Climate Action and Sustainable Growth and another area called Mobility and Transportation.

- Starting in March 2023, development application reports presented to the Planning and Environment Committee contained a climate and environmental impact summary appendix where pertinent information to evaluate a proposed development's alignment with London's climate action commitments were made readily available. This addition is the first step towards applying a climate lens to development proposals.

- Procurement staff have initiated background work required to increase actions, considerations and requirements for the sustainable purchasing section of the Procurement of Goods and Services By-law.

- London Fire Department, Finance and Procurement have worked together to release the tendering for the construction of Firehall 15, which includes the requirement that the facility be a net zero emissions building.

- Planning and Economic Development's Long-Range Planning group is engaging consultants to assist with the assessment of London's Environmentally Significant Areas' inclusion in the Corporate Asset Management Plan.

- Green in the City, an awareness and education initiative focusing on the environment and climate change, covered a period from November 2022 to April 4 by traveling to different libraries and City facilities across London. The initiative was a collaboration between London Public Library, London Environmental Network and the City.

2.1.4 Upcoming Activities in 2023

Many activities either underway and finishing or starting later in 2023 will build upon the initial CEAP implementation momentum in 2022. A sample of those items include:

- Consultation and engagement to inform and direct the City's climate change adaptation plan will commence in Q2 2023 with the release of a Discussion Primer, building upon previous efforts from City staff, community members and non-government agencies.

- Working with Sustainability Solution Group (SSG) to implement a tailored emissions reduction and financial model of London to identify the financial impacts of potential community low-carbon pathways, including an implementation plan that will inform the next iteration of the CEAP.

- Working with the Clean Air Partnership to submit a FCM Community Efficiency Financing Grant and Loan Preliminary Application for the development of a Residential Energy Efficiency Retrofit Pilot Program in London.

- Working with the Canadian Home Builders' Association and the London Home Builders' Association to provide training to local renovators for the Towards Cost-Effective Net-Zero Energy Ready Residential Renovations project.

- City staff from Planning and Economic Development, Environment and Infrastructure, and Finance Supports are working collaboratively to review and provide options to reduce, restrict, or phase out fossil fuel consuming landscaping equipment (e.g., lawnmowers, trimmers, leaf blowers) by completing a study of emerging best practices, applicable legislation and jurisdiction, costs and benefits, potential incentive programs, and other factors.

- Finalization of the biosolids management master plan to guide Wastewater planning for the next 10 to 20 years and capitalize on potential synergies to reduce energy use, reduce greenhouse gas emissions and co-manage landfill gas and source-separated organics management.

- Hosting an event in the fall of 2023 to expand the audience for engagement on the CEAP and support the sharing of knowledge on green building and development issues.

- Near the end of 2023, it is expected that supply chain delays will have been overcome and the Green Bin program for residential source-separated organics collection and management will be in place by late fall/early winter.

- Finalization and launch of a Transportation Management Association to support the mobility needs of Londoners and London's employers.

- Development of a bicycle parking plan to guide the build-out of both short-term and secure, longer-term bicycle parking infrastructure as input into the MMP Plan.

- Updating the Urban Forest Strategy and the associated Tree Planting Strategy is underway, with expectations for it to be presented to Council later in 2023. Many challenges to achieving the pace of tree planting required to meet the 2065 tree canopy goal of 34% within the built area boundary will be considered in the update. Significant City efforts have been put forth recently to maximize plantings on City-owned lands, so a significant focus of the forthcoming strategy update is expected to be on enabling, encouraging and supporting tree planting on private property.

- Strengthening the protection provided by the Broughdale Dyke, which protects 190 properties north of downtown from Thames River flooding, is expected to start in late 2023 with the support of Federal funding from the Disaster Mitigation and Adaptation Fund (DMAF).

- Creation and installation of signage to both educate and bring attention to climate action projects in the community will be undertaken (e.g., West London Dyke informational sign, Urban Roots urban farm, etc.).

2.2 Climate Actions by Others in the Community

Achieving the goals of the CEAP requires effort from all sectors in London and is influenced by actions of others outside London. A few recent examples in the sectors Businesses and Institutions and Households, Individuals and Community Groups are listed below. Additional details are provided in Appendix A.

2.2.1 Businesses and Institutions

Enbridge Gas continues to be an active partner with the City of London on local climate actions. Bi-monthly meetings are held with Enbridge Gas and City of London staff to share updates on activities and explore opportunities for collaboration. The hybrid home heating pilot in London is one high-profile example of a project that originated from these regular meetings. Enbridge's conservation programs, such as Home Efficiency Rebate Plus and Savings By Design, form the backbone of many climate actions undertaken by Londoners and London businesses.

In recent years, it is important to note that electricity conservation programs have been delivered at the provincial levels by the Independent Electricity System Operator (IESO) through programs like Save on Energy. However, London Hydro continues to support local climate actions, including partnering with Enbridge Gas for their hybrid heat pump pilot, continuing to lead the deployment of Green Button data tools for customers, and offering feedback on charging infrastructure and connection to the distribution on the Zero Emission Bus Strategy.

London Health Sciences Centre (LHSC) provided a presentation to SPPC on February 7, 2023 on a master planning process for the lands located at Wellington Road and Commissioners Road. LHSC has started discussions with City staff regarding addressing CEAP's Area of Focus 3, Transforming Buildings ad Development, as part of this overall project.

Sifton Properties' West 5 net-zero energy residential and commercial development continues to be built out, employing many innovations that are likely to become commonplace as London strives for net-zero emissions by 2050.

Eve Park is a new net-zero community being built adjacent to West 5. This includes an innovative electric vehicle car-share program as part of the development.

The London Chamber of Commerce 2022-2025 Strategic Plan notes "We can support our member's mandates and the public's demand for business action on environmental sustainability through policy development and educational resources for our members."

Western University has committed to reduce their greenhouse gas emissions by at least 45 per cent by 2030 from 2005 levels, and to achieve net-zero emissions for campus operations by 2050. As part of Western's emission reduction plans, a district energy loop is being implemented on campus. Western's campus also has 13 LEED® certified buildings.

In 2022, Western University was ranked #1 in Canada for its work toward the United Nations Sustainable Development Goals and #3 in the world based on research, stewardship, outreach and teaching.

Fanshawe College's Greenhouse Gas Reduction Roadmap and Action Plan has set the goal to reduce the college's greenhouse gas emissions by 30 per cent below 2013 levels by 2030 and by 80 per cent by 2050. Fanshawe's GHG Reduction Strategy involves four key elements: conservation and demand management, space optimization and net zero buildings, fleet and facility electrification, and renewable energy.

Goodwill Industries will lead the implementation of the Circular Economy Work and Training Platforms Program to help grow social enterprise by creating living wage skilled jobs and training opportunities for vulnerable and marginalized populations

disproportionately impacted by COVID-19, and to improve environmental impacts in the textile industry. This work includes funding from the London Community Recovery Network.

In terms of examples from smaller London businesses:

- Anderson Craft Ales received federal government funding to buy and install carbon capture technology to replace the carbon dioxide normally purchased to help carbonate their beer; and
- Northern Commerce, a London tech firm, provided e-bikes to all their staff to help reduce vehicle use.

Green Economy London has grown to 65 members – the fastest growing Green Economy Hub in Canada. Activities in 2022 include:

- Green Project Support incentives for members to implement sustainability projects;
- Employee engagement activities such as Workplace Green Up and Green Wheel;
- Launch of the EV Charger Incentive Program; and
- Green Leader Awards for the London & District Construction Association, Play Away Indoor Park, Heeman's, and Graphenstone.

2.2.2 Individuals, Households and Community Groups

The London Environmental Network (LEN), with its 46 members, carried out about 40 projects and programs in 2022, including Greener Homes London, the Environmental Action Incubator Program, Clean Energy in Remote & Rural Communities: Deshkan Ziibiing Retrofit Pilot Program, EcoLeaders: Youth Environmental Leadership Program, Residential Rain Garden Pilot and a Nonprofit Resiliency Project.

With funding from the London Community Recovery Network, LEN will accelerate building retrofits carried out by businesses and residents through its programs, Green Economy London (GEL) and Greener Homes London (GHL). Examples of building retrofits include switching to energy-efficient or renewable energy options for heating/cooling and appliances, improving insulation and ventilation systems, and other resource-saving improvements in existing buildings.

Climate Action London, a not-for-profit community group and member of the London Environmental Network, has hosted environmental-themed film screenings, co-hosted EarthFest and climate march activities in downtown London and hosts the London chapter of Greening Sacred Spaces.

Working through the Tamarack Institute from Waterloo, the City along with four community partners (Climate Action London, ReForest London, London Environmental Network and Pillar Nonprofit Network) and the City participated in a Canada-wide Community Climate Transitions project designed to foster collaboration through a multi-solving approach that advances social, environmental and economic growths simultaneously. This project resulted in several collective impact projects including the development of "CONNECT with the London Climate Plan", aimed at engaging Londoners and encouraging them to take action being led by Climate Action London.

Planning for the 2nd annual EarthFest started in the fall of 2022 and was delivered on April 22, 2023. It was led by numerous community groups (e.g., Reimagine Institute for Community Sustainability) and individuals and represents the largest environmental and climate change event in London.

In terms of actions taken by individual households:

- 316 households signed up for Enbridge Gas's hybrid home heating (heat pump) pilot project and the follow-up Clean Home Heating Initiative.

- 1,158 households completed home energy retrofits using incentives from Canada Greener Homes and/or Enbridge Gas.

- 8.1% of new vehicles registered in London were low-emission vehicles; 4.9% were gas-electric hybrid vehicles and 3.2% were zero emission vehicles.

- The Loewen-Nair household won Canadian Geographic's inaugural Live Net Zero challenge, with a grand prize of $50,000 for their actions that included using moving from the suburbs into central London to reduce the need for driving, using e-bikes for daily transportation, and switching to a heat pump for space heating.

2.3 Climate Actions by Other Levels of Government

Overall, in 2022, the provincial government's role in climate action has included activities for electric vehicles; announcements supporting exploration for critical minerals to assist with electric battery production; more funds for EV chargers across Ontario; provided up to $4.5 million through the Clean Home Heating Initiative to bring hybrid heating to up to 1,000 households in four cities including London; the Ontario Minister of Energy has asked for a report on a moratorium on the procurement of new natural gas generating stations and to develop an achievable pathway to zero emissions in the electricity sector in Ontario; and updating floodplain mapping.

The federal government's role in climate action in 2022 has included the launch of consultations to develop Canada's Clean Electricity Regulations; recapitalized the Zero Emission Vehicle Infrastructure Program and extended the program to March 31, 2027; incentives for Zero-Emission Vehicles; allocated $63.8 million to map flood hazards in high-risk areas; issued their Clean Fuel Regulations; established a Greenhouse Gas Offset system for activities not covered by carbon pricing; released Canada's Methane Strategy to cut methane emissions by more than 35 per cent below 2020 levels by 2030; and in November 2022, "Canada's National Adaptation Strategy: Building Resilient Communities and Strong Economy" was released.

2.4 Greenhouse Gas Emissions

2.4.1 Corporate Energy-Related Emissions

Current corporate energy-related emissions have been influenced by the existing 2019-2023 Corporate Energy Conservation and Demand Management (CDM) Plan approved in 2018.

In 2022, corporate energy-related greenhouse gas emissions were 18,900 tonnes of equivalent carbon dioxide. This is 58 per cent lower compared to 2007, the baseline year for measuring progress (Figure 1). Greenhouse gas emission reductions have been observed across the corporation since 2007, except for fleet vehicles. Most of the emission reductions since 2007 are due to a significantly cleaner electricity grid in Ontario compared to 2007, combined with corporate energy efficiency and conservation efforts.

A summary of major trends influencing 2022 corporate greenhouse gas emissions are identified on Table 6. Compared to recent years, greenhouse gas emissions from Ontario's electricity grid increased in 2022. Given that electricity represents 57 per cent of all the energy used by the City, changes in Ontario's electricity grid will have a big impact on corporate energy-related emissions. As a result, the City's greenhouse gas emissions in 2022 are about 1,300 tonnes (seven per cent) higher than they would have been if Ontario's electricity grid emissions had not changed from recent levels.

Figure 1 Corporate Energy-Related Greenhouse Gas Emissions to Date Compared to Corporate GHG Emission Reduction Targets

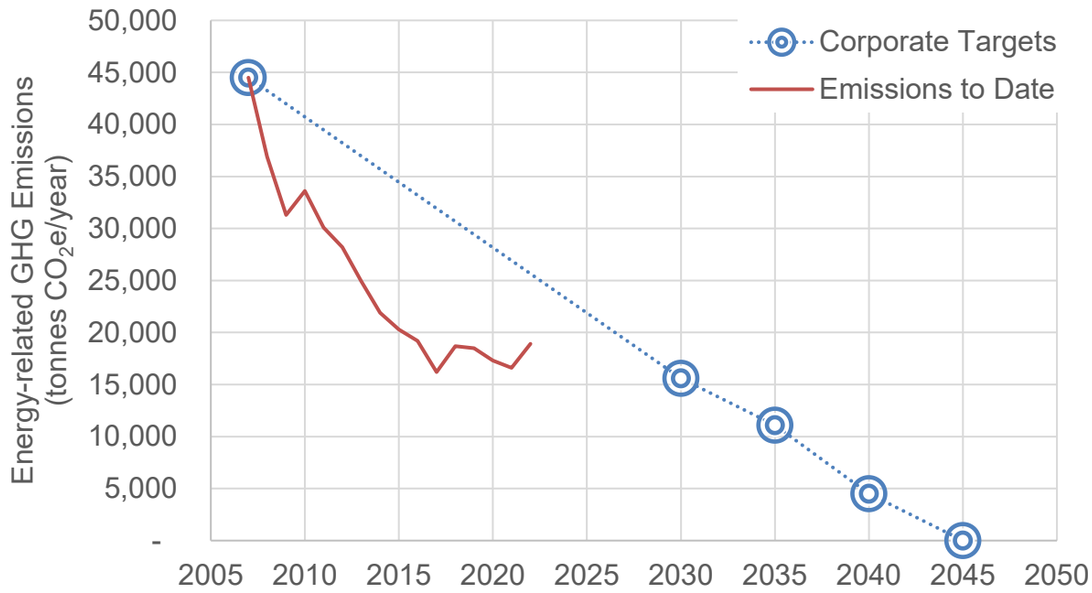


Table 6: Summary of Major Trends and Occurrences in 2022 Influencing Corporate Greenhouse Gas Emissions

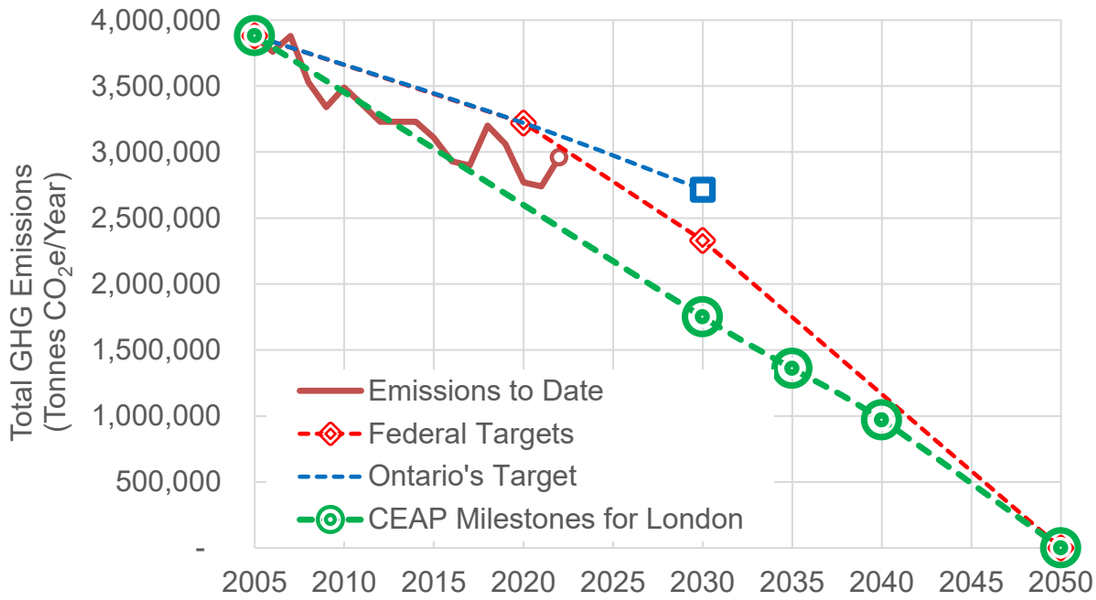
Positive	Unchanged or Unsure	Negative
• Total energy use was down 5.3% from 2018 levels, exceeding the 2019-2023 CDM Plan goals • Energy use by wastewater treatment operations was down 12% from 2018 levels • Diesel fuel consumption decreased by 11% from 2018 levels, due in part to switching 6 solid waste packers to CNG	• 4% decrease in building energy use due in part to pandemic work-from-home measures • Overall fleet emissions – reductions from reduced diesel use offset by increased gasoline use	• GHG emissions intensity of Ontario's electricity grid has increased • Energy used for water distribution increased by 9% from 2018 levels due to equipment issues, which have been repaired • Increased number of rental fleet vehicles due to COVID-19 health requirements increased gasoline usage by 14% from 2018 levels

From an energy commodity perspective, natural gas and diesel are London's two largest sources of energy-related emissions. Measures to electrify building heating, reduce vehicle fuel use, and to use zero emission vehicles and fuels will be priorities. However, given that greenhouse gas emissions from Ontario's electricity grid are expected to climb even further this decade, direct investment in renewable electricity generation for municipal facilities may be needed to help meet London's 2030 target.

2.4.2 Community-wide Emissions

Total greenhouse gas emissions in 2022 were 2.96 million tonnes of equivalent carbon dioxide, with half of the emissions coming from personal transportation and energy use at home. This is 24 per cent lower than 2005 levels (Figure 2). However, compared to 2021, the highest greenhouse gas emission reduction year to date, there has been an increase primarily due to colder winter weather increasing natural gas use for building heat, combined with Ontario's electricity grid relying more on natural gas use.

Figure 2 - Community Emissions to Date Compared to Targets for London, for Ontario, and for Canada



Like corporate energy related emissions above, emission reductions since 2005 are due to a significantly cleaner electricity grid in Ontario, combined with energy efficiency and conservation efforts in housing, commercial buildings, and local industry. However, it is important to note the extraordinary impact of the COVID pandemic on transportation emissions, which lowered community-wide emissions by approximately 12 per cent in 2020 and 2021 from pre-pandemic levels.

Even with the significant effect of COVID-19 on GHG emissions in the community, emissions in 2022 were above the trendline needed to meet London's new science-based targets, notably the 2030 target for a 55 per cent reduction from 2005 levels.

Energy use is responsible for 95 per cent of all GHG emissions from human activity in London. Not only does burning fossil fuels such as gasoline, diesel, and natural gas produce carbon dioxide – the most common GHG associated with human activity – but the use of electricity also contributes to GHG emissions.

A summary of major trends influencing 2022 community greenhouse gas emissions are identified on Table 7. Ninety per cent of Ontario's electricity was generated from emissions-free sources in 2022, such as nuclear and hydro-electric generating stations as well as renewable sources (wind and solar).

However, Ontario still relied on fossil fuels such as natural gas to generate ten per cent of the electricity Londoners used in 2022, a higher share than in recent years. As a result, this increase in natural gas use for power generation is estimated to be responsible for an additional 45,000 tonnes of emissions from London in 2022 – 1.6 per cent higher.

Whether emissions continue to decrease depends upon the impact of energy and fuel conservation efforts, provincial and federal climate change policies (including incentives), climate trends, economic growth, and consumer choices. Overall, the trends in Table 7 impacted London's community greenhouse gas emissions in 2022.

Table 7: Summary of Major Trends and Occurrences in 2022 Influencing Greenhouse Gas Emissions

Positive	Unchanged or Unsure	Negative
• Residential energy use per person has seen consistent reductions • Average distance travelled by bike increased • Number of hybrid and electric vehicles in London has increased • Retail sales of fuel per person in 2022 were only 2.5% higher than 2021 and still about 20% below pre-pandemic levels • Installed solar power generation capacity has increased • Industrial, commercial, and institutional energy use per person has seen consistent reductions • Energy productivity ($ GDP per unit energy) increased	• Transportation energy use per person was still noticeably below pre-pandemic levels, but there is uncertainty whether current post-pandemic "hybrid" work arrangements are permanent	• GHG emissions intensity of Ontario's electricity grid has increased • Market share sales of larger personal vehicles (e.g., pickups and SUVs) has increased • Electric vehicle adoption rate in Ontario was lower than Canada's overall rate • Electric vehicle adoption rate in London was lower than Ontario's overall rate

2.4.2 Consumption-related Emissions

In 2019, the City of London started highlighting the importance of consumption-related greenhouse gas emissions. These are defined as all the greenhouse gas emissions associated with providing goods and services to Londoners, including those that take place outside London's boundaries. A good example would be the emissions associated with food as the majority comes from outside London. There are emissions associated with growing crops, feeding animals, preparing food products for market, and transporting these to market.

The 2022 CEAP Progress Report furthers the discussion for the purpose raising awareness about the importance of all emissions, locally and globally. New information is presented based on an approach being used by a growing number of Canadian municipalities. An improved understanding London's consumption-related emissions helps to support the importance of local environmental and climate action initiatives such as:

- Reducing the amount of food waste (food waste avoidance);
- Buying durable products;
- Buying local products;
- Recycling and the circular economy (end-of-product-life recovery and reuse); and
- Repurposing and renovating existing buildings instead of tearing them down.

2.5 Weather Trends and Impacts

Documenting weather events and trends that will eventually influence the evolution of London's climate is part of Areas of Focus 8, Adapting and Making London More Resilient, and will be an important foundation of the development of the Climate Change Adaptation Discussion Primer Plan. Wind, rain and temperature events are examples of how severe weather will impact the ability of London to adapt and become more resilient. These severe weather events plus the overall incremental increase in seasonal temperatues and any cascading effects that these changes cause (e.g., Urban Heat Island impacts), will form the basis of future annual reporting.

Locally, the most significant weather event was the May 2022 windstorm, termed a “derecho” that included two tornadoes in London. Impacts of the storm were experienced throughout the city and included downed trees and damage to buildings. The stormfront then travelled east across Ontario and into Quebec and became the most deadly and costly thunderstorm event on record in Canada (Northern Tornadoes Project, Annual Report 2022).

Canada-wide, supply chain issues were exacerbated by extreme weather events (e.g., wildfires, atmospheric rivers, landslides) impacting transportation infrastructure on both coasts. Similarly, produce prices spiked over the past year due, in part, to droughts and wildfires in agricultural areas of the American southwest, like California.

Weather conditions also impact the energy demand needed to heat or cool a home or business. Over the last 10 years, most winters and summers have been warmer than they were over the 1971-2000 period. Using this data, it can be estimated that building heating needs were about seven per cent lower than they would have been back in the 1971-2000 period, while air conditioning needs were 30 per cent higher. On a year-by-year basis, differences in weather conditions creates variability in estimated emissions. In 2022, there was an eight per cent increase in heating degree-days from 2021, with a corresponding increase in natural gas use per person of six per cent.

3.0 Financial Impact/Considerations

Similar to what was reported when CEAP was approved in 2022, investment in climate action over the full term of the CEAP (to 2050) by the City, businesses and residents is anticipated to be significant. Investments must also come from other levels of government to assist local government. Some of these investments are anticipated to align with and sometimes replace planned future spending. In some cases, investments to achieve CEAP goals may result in opportunities for net savings, though additional up-front capital costs may be required to realize lower lifetime asset costs. In particular, net savings are expected for some infrastructure if total lifecycle costs (capital, operating and maintenance) are evaluated with the expected cost burden of an escalating price of carbon and the incorporation of climate change impact risks.

Several short term and longer terms activities are underway at the City including:

- The launch of a project for energy, emissions, land-use, and financial scenario modelling to map possible growth and land use scenarios to determine how to reduce emissions, create jobs, and optimize land use to create equitable, decarbonized, healthy communities. Some of the most important and difficult questions to answer include determining the costs and benefits of CEAP and trying to achieve net-zero emissions by 2050;

- The launch of a project to review and advance City staff estimates for reaching net-zero emissions for Corporate assets (e.g., fleet, facilities, street lights, wastewater, water, landfill);

- Current work on the City’s Corporate Assessment Management update including the estimated expenditures associated with climate change and City assets;

- Further refining the order of magnitude costing included in Council’s 2023-2027 Strategic Plan and for consideration in the 2024-2027 Multi-Year Budget process;

- Preliminary evaluation carbon accounting/budgeting options for potential future implementation; and

- The creation of Climate Change Investment and Implementation Plan which plans out potential investments over multiple multi-year budgets, including 10 and/or 20 years capital plans, funding strategies, etc.

4.0 Key Issues and Considerations

In London, like every other municipality, there are many evolving and often competing priorities that need to be balanced. The climate crisis is currently accompanied by a homelessness crisis, a housing affordability crisis, lingering effects of the international COVID-19 public health crisis and numerous other near- and long-term issues that will or already do have a significant impact on the city and its residents. Taking action on climate change now, however, increases the likelihood those actions will be impactful and reduces the costs associated with deferral and the impacts that will be disproportionately felt by the most vulnerable populations.

The latest synthesis report from the United Nations Intergovernmental Panel on Climate Change (IPCC) (March 2023) indicates that every increment of global warming will intensify multiple and concurrent hazards and that “deep, rapid, and sustained reductions” in greenhouse gas emissions would lead to discernible slowdown in global warming. Furthermore, the report indicates that, “deep, rapid, and sustained mitigation” and accelerated implementation of adaptation actions in this decade would reduce projected losses and damages for humans and ecosystems, and deliver many co-benefits, especially for air quality and human health. The IPCC also clearly states, however, that there is a “rapidly closing window of opportunity to secure a liveable and sustainable future for all.”

As was articulated in the CEAP, municipalities are not solely responsible for acting on climate change, but are one of many actors locally, nationally, and internationally that need to take action. Recent policy decisions from the Ontario government will create additional challenges for reducing local emissions and the ability for municipalities to influence them, including the recent changes to restrict aspects of development-related approvals through Bill 23, and a policy position to support increased electricity generation from natural gas power plants that will result in higher emissions. These decisions will impede progress for advancing emissions reduction efforts in London and throughout Ontario and put even more emphasis on the importance of actions by others to strive to achieve science-based, fair share targets for emissions reductions.

Recent announcements by Stellantis, a Netherlands-based automaker, and Volkswagen to invest billions of dollars into battery and electric vehicle manufacturing facilities in Brampton, Windsor and St. Thomas are signs that private industry is embracing the clean energy transition. Opportunities for economic growth and prosperity that align with a low carbon, sustainable future will continue to appear, and London will be in a strengthened position if the City is placing a high priority on climate action.

Conclusion

Just over 90% of the CEAP’s 2022 actions, both Timeline and Ongoing Actions, have been initiated by City staff or by organizations in London. Over 70% of the 200 CEAP actions have been initiated. This progress is considered by City staff to be on target overall considering that not all actions were planned for implementation in 2022 and that new funding and resources for these efforts will be considered as part of the upcoming multi-year budget process. In addition, the near completion of foundational actions and the creation of tracking systems have built a strong foundation to support work in 2023 and beyond.

A collection of 66 measures of progress have been identified and will be added to in years ahead to measure progress on the goals of the CEAP and progress towards expected results. The Climate Lens Framework has continued to be a valuable tool for staff to begin to account for climate change considerations in work throughout the corporation and will continue to evolve as it is embraced enterprise-wide.

The reduction in emissions from the impacts of the COVID-19 pandemic seen in 2020 and 2021 are starting to rebound as Londoners started to return to pre-pandemic activities and travel.

The attached 2022 CEAP Progress Report provides additional details pertaining to specific actions within each of the ten Areas of Focus. It also details, corporate and community GHG inventory data and commentary regarding the provincial, national, and global context within which London's climate action efforts should be viewed.

With intensifying warnings from the IPCC the latest synthesis report released in March 2023, it is well understood that action must be taken to reduce emissions and improve societal resilience to both reduce and prepare for the impacts of changing climate.

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Appendix A 2022 Climate Emergency Action Plan Progress Report

Appendix A
2022 Climate Emergency Action Plan Progress Report

Climate Emergency Action Plan 2022 Progress Report

May 2023

#LdnOnt ClimateAction

London CANADA

Land Acknowledgement

We acknowledge that we are gathered today on the traditional lands of the Anishinaabek (AUh-nish-in-ah-bek), Haudenosaunee (Ho-den-no-show-nee), Lūnaapéewak (Len-ah-pay-wuk) and Attawandaron (Add-a-won-da-run).

We acknowledge all the treaties that are specific to this area: the Two Row Wampum Belt Treaty of the Haudenosaunee Confederacy/Silver Covenant Chain; the Beaver Hunting Grounds of the Haudenosaunee NANFAN Treaty of 1701; the McKee Treaty of 1790, the London Township Treaty of 1796, the Huron Tract Treaty of 1827, with the Anishinaabeg, and the Dish with One Spoon Covenant Wampum of the Anishnaabek and Haudenosaunee.

This land continues to be home to diverse Indigenous peoples (First Nations, Métis and Inuit) whom we recognize as contemporary stewards of the land and vital contributors to society. We hold all that is in the natural world in our highest esteem and give honor to the wonderment of all things within Creation. We bring our minds together as one to share good words, thoughts, feelings and sincerely send them out to each other and to all parts of creation. We are grateful for the natural gifts in our world, and we encourage everyone to be faithful to the natural laws of Creation.

The three Indigenous Nations that are neighbours to London are the Chippewas of the Thames First Nation; Oneida Nation of the Thames; and the Munsee-Delaware Nation who all continue to live as sovereign Nations with individual and unique languages, cultures and customs.

This Land Acknowledgement is a first step towards reconciliation. It is the work of all citizens to steps towards decolonizing practices and bringing our awareness into action. We encourage everyone to be informed about the traditional lands, Treaties, history, and cultures of the Indigenous people local to their region.

Note to Reader

This is 2022 Progress Report is the first of many reports that will be produced to communicate the efforts of many to address climate change in London, Ontario. The direction for addressing climate change was set with the first Climate Emergency Action Plan (CEAP) for London approved by London City Council in April 2022.

What is the purpose of the Climate Emergency Action Plan (CEAP)?
To focus and help coordinate efforts and acknowledge the need for leadership on climate change across London and beyond our borders, specific actions that will contribute making a difference in London are organized into 10 Areas of Focus:

1. Engaging, Inspiring and Learning from People
2. Taking Action Now (Household Actions)
3. Transforming Buildings and Development
4. Transforming Transportation and Mobility
5. Transforming Consumption and Waste as Part of the Circular Economy
6. Implementing Natural and Engineered Climate Solutions and Carbon Capture
7. Demonstrating Leadership in Municipal Processes and Collaborations
8. Adapting and Making London More Resilient
9. Advancing Knowledge, Research and Innovation
10. Measuring, Monitoring and Providing Feedback

The combined activities and actions across all Areas of Focus rely on many working together and collaborating; people, businesses and institutions making changes to reduce their reliance on fossil fuels (i.e., the number one cause of greenhouse gas emissions); and being proactive on making more sustainable choices that meet their needs, lifestyles and business objectives. Choices are available and changes are needed now. Inaction will result in higher costs in the future and potentially greater hardship if London does not become more resilient.

Why report on progress of the CEAP?
The CEAP addresses short and long-term objectives that can only be achieved through awareness and consistent efforts from all sectors in London. By reporting regularly on progress towards our goals, milestone targets and outcome areas, Londoners, businesses and employees can track performance, collectively celebrate successes, and acknowledge and engage each other on developing and/or changing climate action needs as our understanding of climate change evolves.

Who is this report written for?

This report is written for anyone interested in understanding how the City, businesses, institutions, community organizations, households and individuals are progressing with climate action in London. Details from this report can be used to improve personal and household decisions; provide information for student projects; allow businesses, institutions and non-profits to learn what others are doing; and for volunteers to find important roles to help the community.

How is progress going to be reported?
Section 2 of this report details the five main areas of progress addressed in this report:

1. CEAP actions by Area of Focus
2. Climate actions by others in the community
3. Climate actions by other levels of government
4. Greenhouse gas emissions
5. Weather trends and impacts

What can I learn from this report?
Each section of the report is a short story on its own. The report provides information on where efforts are being directed, the results of those efforts (where available), as well as some of the upcoming projects and actions to address climate change.

Why is there so much information presented?
Climate change is influenced by all sectors of society. Actions and solutions will have to come from all sectors as well. This means there is a lot of information and a lot to talk about! This report provides information to those interested in understanding what is happening in each of the Areas of Focus that make up the CEAP.

Do I need to read this progress report to take action on climate change?
No, you do not. However, any time spent reading the report will likely improve your understanding of what is going on in London. There are many ways to take action at the individual or household level that have been summarized at London.ca/climateaction. Many community groups in London have websites that provide opportunities for you to take action. Many other resources are available at London Public Library, book stores or on-line.

Who can I contact if I need clarification or more information?
City staff as part of the Climate Change and Environmental Stewardship area of the Environment & Infrastructure Service Area can be reached for any question or comment at climateaction@london.ca. In some cases, individual projects and programs have specific lead staff that will be asked to help with information.

Executive Summary

In April 2022, Municipal Council unanimously approved the Climate Emergency Action Plan (CEAP) with the goals of reducing community-wide emissions to net-zero by 2050, improving London's resilience to climate change impacts and ensuring that everyone in London is able to participate in working to reduce emissions. The 2022 CEAP Progress Report covers the period from May to December 2022 (eight months) and introduces some highlights in 2023.

Reporting progress on CEAP involves five key outcome areas (where measurements are possible, or actions can be followed):

1. CEAP Actions by Area of Focus
2. Climate Actions by Others in the Community
3. Climate Actions by Other Levels of Government
4. Greenhouse Gas Emissions
5. Weather Trends and Impacts

1. Progress on CEAP Actions by Area of Focus

To set the stage for the successful implementation of the CEAP, 17 foundational actions were identified in the February 8, 2022 Strategic Priorities and Policy Committee (SPPC) report. All of the foundational actions have been initiated, bout half have been completed, and ongoing efforts to complete remaining actions continue in 2023. Some actions in the CEAP address specific deliverables or achievements that can be tied to a timeline while other actions require ongoing efforts and do not have a specific targeted end date. Of the 200 actions, 57% (113) have a Timeline and 43% (87) are considered Ongoing Actions. Of the 74 Timeline Actions scheduled to start in 2022, 65 (88%) have been started. Similarly, of the 62 Ongoing Actions schedule to start in 2022, 58 (94%) have been started.

The City of London's CityGreen display shares information about the Climate Emergency Action Plan with Londoners at events and festivals

Use of the Climate Lens Framework on Corporate Projects and Programs

Creation and implementation of the City's Climate Lens Framework has advanced since the approval of the CEAP, with many work groups within different City Service Areas using the approach to embed climate considerations into their decision-making. Some notable projects and initiatives where the Climate Lens Framework was or is actively being used include road infrastructure projects, landfill gas management, wastewater treatment and the Biosolids Management Master Plan, Corporate Master Accommodation and Alternative Work Strategy, development of the Mobility Master Plan and ReThink Zoning.

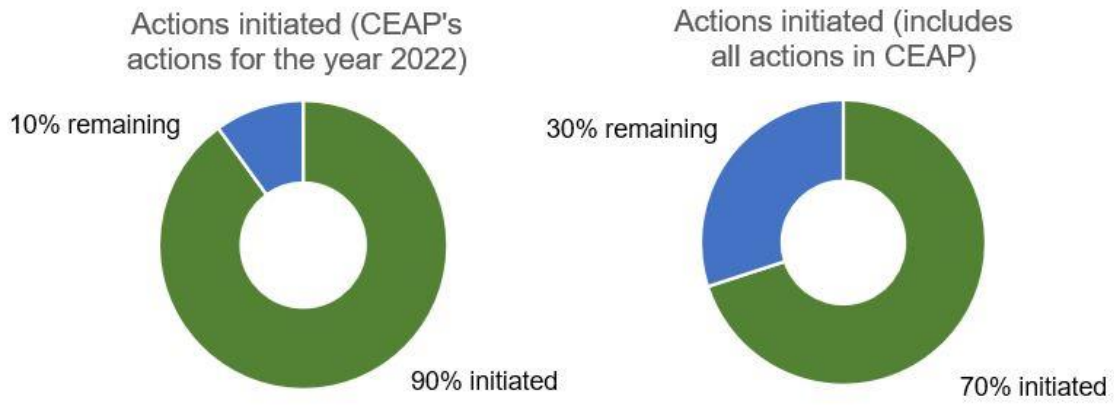
The methane flare stack at the W12A Landfill

Indicators of Progress Towards Expected Results

About 100 potential indicators of progress were initially identified in the CEAP. New indicators will be added, and some existing indicators will evolve over time. A subset of 66 of the initial 100 indicators represent the baseline data that is currently available to assist with measuring progress.

In Summary

Just over 90% of the CEAP's 2022 actions, both Timeline and Ongoing Actions, have been initiated by City staff or by organizations in London. Over 70% of the 200 CEAP actions have been initiated.



2. Progress on Climate Actions in the Community

Achieving the goals of the CEAP requires effort and actions from all sectors in London and is influenced by the actions of others outside of London.

Several examples in 2022 and the early part of 2023 by businesses, institutions, and community groups such as EarthFest, business tree planting, green awards, more communications materials promoting sustainability and climate change, participation and guidance on how to take action on climate change, are among the many initiatives that occurred in London. There are currently limited measures that indicate if climate action increased in 2022.

The City of London participated in several community-led events, including Green in the City with London Environmental Network and London Public Library, EarthFest, and climate change information sessions with PROBUS Clubs of London

What is being reported by organizations and/or shared through other communications' methods (e.g., social media, websites, reporting by media, etc.) would suggest there is an increase in activity in London by local organizations.

3. Progress on Climate Actions with Other Levels of Government

Actions taken at the provincial and federal government levels directly or indirectly influence climate change actions and greenhouse gas emissions in London. At the international level, details and other sources can be found in numerous locations including the United Nations.

Actions on climate change are occurring at both levels of government in Canada and around the world. Actions vary widely across Canada. Concerns that are often raised include are the actions moving quickly enough, do the actions have enough funding and are the problems being addressed.

Peter Fragiskatos, Parliamentary Secretary to the Minister of National Revenue and Member of Parliament for London North Centre, and Mayor Josh Morgan, announce a joint investment to raise and solidify the Broughdale Dyke

Measuring progress in Ontario and Canada focuses primarily on greenhouse gas reduction numbers which are available on government websites.

4. Greenhouse Gas (GHG) Emissions

Corporate (City of London) Energy-Related Emissions

Current corporate energy-related emissions have been influenced by the existing 2019-2023 Corporate Energy Conservation and Demand Management (CDM) Plan. In 2022, corporate energy-related greenhouse gas emissions were 18,900 tonnes of equivalent carbon dioxide. This is 58 per cent lower compared to 2007, the baseline year for measuring progress. Corporate greenhouse gas emissions continue to track below the trend line to achieve future reduction targets.

Greenway Wastewater Treatment Plant

Compared to recent years, there has been an increase in Corporate greenhouse generation primarily due to Ontario's electricity grid relying more on natural gas use in 2022. Given that electricity represents 57 per cent of the corporate energy use, changes in Ontario's electricity grid will have a big impact on future corporate energy-related emissions.

Positive corporate greenhouse gas emission trends and occurrences in 2022 include:

- total energy use was down 5.3% from 2018 levels, exceeding the 2019-2023 Corporate Energy CDM Plan goals;
- Energy use by wastewater treatment operations was down 12% from 2018 levels; and
- Diesel fuel consumption decreased by 11% from 2018 levels, due in part to switching six solid waste packers to CNG.

Negative corporate greenhouse gas emission trends and occurrences in 2022 include:

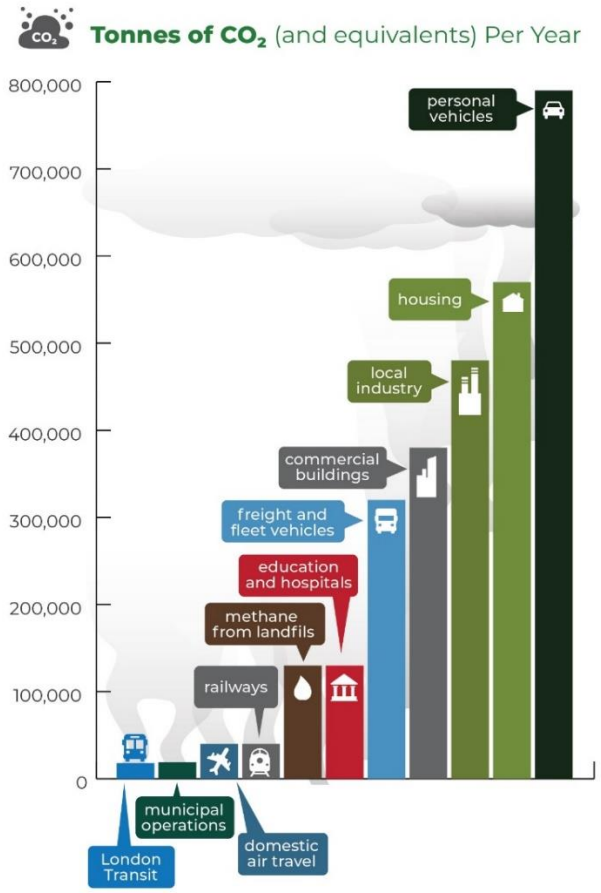
- Greenhouse gas emissions intensity of Ontario's electricity grid has increased by over 40% from 2018 levels which increase corporate emissions;
- Energy used for water distribution has increased by 9% from 2018 levels due to equipment issues at the Southeast Reservoir and Pumping Station (SERPS) that have since been repaired; and
- Increased gasoline usage by 14% from 2018 levels due to COVID-19 health requirements that created the need for additional single occupant work vehicles (e.g., pickup trucks).

Community-wide Emissions

Total greenhouse gas emissions in 2022 were 2.96 million tonnes of equivalent carbon dioxide, with half of the emissions coming from personal transportation and energy use at home. This is 24 per cent lower than 2005 levels, the baseline for measuring progress.

When compared to 2021, the highest greenhouse gas emission reduction year to date, there has been an increase primarily due to colder winter weather increasing natural gas use for building heat, combined with Ontario's electricity grid relying more on natural gas use.

Even with the significant effect of COVID-19 on GHG emissions in the community, emissions in 2022 were above the trendline needed to meet London's new science-based targets, notably the 2030 target for a 55 per cent reduction from 2005 levels.



The figure above illustrates the estimated breakdown of greenhouse gas emissions in terms of human activity, with half of emissions in 2022 coming from personal transportation and energy use at home

Positive community greenhouse gas emission trends and occurrences in 2022 include:

- Residential energy use per person has seen consistent reductions;
- Average distance travelled by bike increased;
- Number of hybrid and electric vehicles in London has increased;
- Retail sales of fuel per person in 2022 were only 2.5% higher than 2021 and still about 20% below pre-pandemic levels;
- Installed solar power generation capacity has increased;
- Industrial, commercial, and institutional energy use per person has seen consistent reductions; and
- Energy productivity ($ GDP per unit energy) increased.

Negative community greenhouse gas emission trends and occurrences in 2022 include:

- Greenhouse gas emissions intensity of Ontario's electricity grid has increased by over 40% from 2018 levels which increase community emissions;
- Market share sales of larger personal vehicles (e.g., pickups and SUVs) has increased;
- Electric vehicle adoption rate in Ontario was lower than Canada's overall rate; and
- Electric vehicle adoption rate in London was lower than Ontario's overall rate.

Consumption-related Emissions

In 2019, the City of London started highlighting the importance of consumption-related greenhouse gas emissions. These are defined as all the greenhouse gas emissions associated with providing goods and services to Londoners, including those that take place outside London's boundaries.

A good example would be the emissions associated with food as the majority comes from outside London. There are emissions associated with growing crops, feeding animals, preparing food products for market, and transporting these to market.

Chris St. Clair, a former broadcaster at the Weather Network, presents about extreme weather at the 2022/2023 series finale of Green in the City at Wolf Performance Hall

The 2022 CEAP Progress Report furthers the discussion for the purpose raising awareness about the importance of all emissions, locally and globally.

5. Weather Trends and Impacts

Documenting weather events and trends that will eventually influence the evolution of London's climate is an important foundation for understanding and preparing for the impacts of climate change. Wind, rain and temperature events are examples of how severe weather will impact the ability of London to adapt and become more resilient.

Locally, the most significant weather event was the May 2022 wind storm, termed a "Derecho" that included two tornadoes in London. They impacted Huron Heights and Wilton Grove areas causing downed trees and damages to buidings.

Looking Ahead (Early Activities in 2023 and Upcoming Activities)

In addition to the activities detailed in the 2022 CEAP Progress Report, action has continued in early 2023 and more activities are to come later in 2023.

Table of Contents

1. Background and Introduction

The Climate Emergency Action Plan (CEAP) is a community-wide plan that was developed between January 2020 and February 2022, following the declaration of a climate emergency in 2019. The CEAP development process included best practices research into the approaches used to address climate change in other Canadian municipalities and the preparation of 13 background documents covering a range of relevant topics.

Community engagement and consultation was conducted throughout the development process, with comments and feedback incorporated into the initial draft CEAP presented to Council in February, 2022 as well as incorporated into the final plan.

The CEAP was unanimously approved by Council in April 2022. The CEAP sets out actions to drive progress towards the following goals:

- Net-zero community greenhouse gas (GHG) emissions by 2050;
- Improved resilience to climate change impacts; and
- Bring everyone along (e.g., ensuring that everyone in London - individuals, households, businesses, neighbourhoods - are able to participate in working to reduce emissions and adapting to change).

The implementation of the CEAP is guided by milestone greenhouse gas emission targets for both London as a whole and the Corporation of the City of London:

- For London as a whole (community-wide):
  - 55 per cent below 2005 levels by 2030;
  - 65 per cent below 2005 levels by 2035;
  - 75 per cent below 2005 levels by 2040; and
  - Net-zero emissions by 2050.

- For the Corporation of the City of London:
  - 65 per cent below 2007 levels by 2030;
  - 75 per cent below 2007 levels by 2035;
  - 90 per cent below 2007 levels by 2040; and
  - Net-zero emissions by 2045.

The implementation of the CEAP is intended to be a whole community effort, with actions identified for the City, the community, businesses and institutions, and leaders throughout and near London.

The 2022 CEAP Progress Report covers the period from May to December 2022 (eight months). Also highlighted are some actions taken in early 2023 and actions to be taken later in 2023.

2. Reporting Progress on CEAP

Reporting and measuring progress on a plan that touches so many aspects of society requires a number of approaches that acknowledges the complexity of the challenge, the roles, responsibilities and limitations of all involved (e.g., of an individual, business, municipality, province, etc.), and the availability of data.

While some measures require data that are simple and inexpensive to collect (e.g., number of CEAP actions started), others may be complex and/or expensive (e.g., total annual carbon removed from the atmosphere by vegetation across the city). Similarly, some data is within the control of a municipality (e.g., metres of sidewalk installed), while many others are controlled by one or more other parties (e.g., how funds collected from carbon pricing are used). Actions taken at the provincial, federal or international levels can have different effects in London ranging from limited effect on climate action (e.g., financial support for international climate efforts in developing countries) through to a daily impact (e.g., increase in carbon emission intensity of the provincial electrical grid as more natural gas is used as an energy source).

Further compounding the challenges of reporting progress on climate action is the fact that some items and areas may show progress and growth but do not show changes in greenhouse gas reductions or resilience due to the longer period of time required for benefits to occur or become visible and recorded.

Based on a review on how other municipal climate change plans report progress and similar large and complex municipal programs, reporting progress on London's CEAP will be accomplished by examining five key outcome areas:

Progress Reporting Outcome Area	Why is it Important to Report Progress in this Outcome Area
1. CEAP Actions by Area of Focus • Actions identified in CEAP by Area of Focus • Indicators of progress towards 2030 Expected Results	Starting and implementing CEAP actions and reporting on indicators are fundamental to achieving the CEAP goals. Progress in this area reflects the prioritization of CEAP actions by City Council, London businesses, community organizations and individuals.
2. Climate Actions by Others in the Community • Business and institutional sectors • Individuals, households and community groups • Others nearby (e.g., First Nations, municipalities, businesses, non-profit organizations)	Actions are required from all sectors of London and the measurement or reporting of progress in this area highlights and supports the efforts throughout the community by diverse climate action participants.

Progress Reporting Outcome Area	Why is it Important to Report Progress in this Outcome Area
3. Other Levels of Government • Provincial • Federal • International	Other levels of government have a significant effect on the ability of a municipality, business, household or individual to take climate action. Reporting progress on climate action by other levels of government is required to establish the context under which local actions may be affecting GHG emissions reductions and resilience improvements.
4. Greenhouse Gas Emissions • Corporate greenhouse gas emissions • Community-wide greenhouse gas emissions	Reducing GHG emissions is one of the three main goals of the CEAP. Progress on this measure is directly quantifiable and core to the purpose of the CEAP.
5. Weather Trends and Impacts • London and Area • Canada • Global	Reporting weather trends and impacts is an important component of tracking a changing climate. Adaptation actions to build a more resilient city need to be based on both existing and anticipated severe weather changes. Weather is also a common starting point with citizens in having conversations about the necessary actions to improve collective resilience to climate change.

These progress reporting outcome areas are addressed in the subsequent sections of this report. Over time, each outcome area will be further defined, and more details provided as information and statistics become available.

3. Progress on CEAP Actions by Area of Focus

What will I learn in Section 3?	You will learn about City led or co-led climate actions that may be very visible in London, may be part of a larger project or program, or actions that help to advance future projects and programs. You will also learn about the progress in implementing actions across the ten Areas of Focus contained in the Climate Emergency Action Plan (CEAP).
Why does Section 3 matter?	Reporting progress on CEAP actions demonstrates that City Council direction is being acted upon and highlights what the community and Council want to see addressed to reduce the impact of climate change. CEAP actions often reflect what is done in other Ontario cities, other cities in Canada similar to London, and other locations where learnings can be used in London.
How can I take action?	Depending on your interest, you may wish to: • provide comments on existing climate change projects and programs; • engage with organizations that work alongside City projects and programs; • become more knowledgeable on what an individual, household, business or not-for-profit can do to reduce greenhouse gas emissions; and/or • share your knowledge and experience with making more sustainable choices.

To set the stage for the successful implementation of the CEAP, 17 foundational actions were identified in the February 8, 2022 Strategic Priorities and Policy Committee (SPPC) report. Each of the 17 foundational actions have been initiated since the CEAP's approval, about half have been completed, and ongoing efforts to complete remaining actions in 2023 (Table 1).

Table 1: Foundational Actions – Status of Implementation

Foundational Actions	Total Actions	Actions Started	Ongoing Actions	Actions Complete
Actions with defined timelines	13	13 (100%)	N/A	7 (54%)
Actions requiring ongoing effort	4	4 (100%)	4 (100%)	N/A
Total	17	17 (100%)		

The CEAP includes 59 Categories of Actions and contains 200 individual actions, ranging from basic to complex actions, across the 10 Areas of Focus. A list of the actions can be found in the appendices of the core CEAP document or in the "Actions at a Glance" document, both available in the documents section at https://getinvolved.london.ca/climate. A breakdown of

the type and progress on actions within each Area of Focus are included in the Tables 2, 3 and 4. The majority of actions were scheduled to start between 2022 and 2024.

Some actions in the CEAP address specific deliverables or achievements that can be tied to a timeline (e.g., Transforming Buildings and Development's Action 2.a. "Reduce or eliminate parking minimums within the Zoning by-law") while other actions require ongoing efforts and do not have a specific targeted end date (e.g., Transforming Transportation and Mobility's Action 2.c. "Continue to support the Active and Safe Routes to School Program"). Table 3 differentiates between these two types of actions and categorize them as "timeline" actions and "ongoing" actions.

Of the 200 actions, 57% (113) have a Timeline and 43% (87) are considered Ongoing Actions. Although climate actions have been slotted into just one Area of Focus, in many cases actions could be in multiple Areas of Focus. This becomes evident when reading through the progress being achieved, the stage of the action and who is involved in the action.

Table 2: Area of Focus Workplan Actions Identified as Timeline or Ongoing

Area of Focus	Total Actions	Timeline Actions	Ongoing Actions
1. Engaging, Inspiring and Learning from People	9	2	7
2. Taking Action Now (Household Actions)	18	6	12
3. Transforming Buildings and Development	22	19	3
4. Transforming Transportation and Mobility	30	22	8
5. Transforming Consumption and Waste as Part of the Circular Economy	21	19	2
6. Implementing Natural and Engineered Climate Solutions and Carbon Capture	15	7	8
7. Demonstrating Leadership in Municipal Processes and Collaborations	44	24	20
8. Adapting and Making London More Resilient	9	4	5
9. Advancing Knowledge, Research and Innovation	9	8	1
10. Measuring, Monitoring and Providing Feedback	23	2	21
Total	**200**	**113**	**87**

The number of Timeline Actions included in each Area of Focus and the implementation status of those actions are listed in Table 3. Of the 74 Timeline Actions schedule to start in 2022, 65 (88%) have been started. An additional 14 Timeline Actions scheduled for 2023 have been started. As of April 2023, 3 (4%) have been completed.

Table 3: 2022 Timeline Actions – Status of Implementation

Area of Focus	Timeline Actions	Actions Started	Actions Complete
1. Engaging, Inspiring and Learning from People	2	2 (100%)	0 (0%)
2. Taking Action Now (Household Actions)	5	5 (100%)	0 (0%)
3. Transforming Buildings and Development	14	11 (79%)	1 (7%)
4. Transforming Transportation and Mobility	19	16 (82%)	1 (6%)
5. Transforming Consumption and Waste as Part of the Circular Economy	15	15 (100%)	0 (0%)
6. Implementing Natural and Engineered Climate Solutions and Carbon Capture	5	2 (40%)	0 (0%)
7. Demonstrating Leadership in Municipal Processes and Collaborations	3	3 (100%)	0 (0%)
8. Adapting and Making London More Resilient	3	3 (100%)	0 (0%)
9. Advancing Knowledge, Research and Innovation	7	7 (100%)	1 (14%)
10. Measuring, Monitoring and Providing Feedback	1	1 (100%)	0 (0%)
Total	**74**	**65 (88%)**	**3 (4%)**

Note: 27 Timeline Actions are scheduled to start in 2023 and 12 more in 2024.

Those actions not started in 2022 will be prioritized in 2023 or 2024 based on the results of implementation planning and allocation of funding and/or resources to support the actions.

The number of Ongoing Actions included in each Area of Focus and the implementation status of those actions are listed in Table 4. Of the 62 Ongoing Actions schedule to start in 2022, 58 (94%) have been started. An additional six Ongoing Actions scheduled for 2023 have been started.

Table 4: 2022 Ongoing Actions – Status of Implementation

Area of Focus	Ongoing Actions	Actions Started
1. Engaging, Inspiring and Learning from People	6	6 (100%)
2. Taking Action Now (Household Actions)	12	11 (92%)
3. Transforming Buildings and Development	2	2 (100%)
4. Transforming Transportation and Mobility	8	8 (100%)
5. Transforming Consumption and Waste as Part of the Circular Economy	2	2 (100%)
6. Implementing Natural and Engineered Climate Solutions and Carbon Capture	5	5 (100%)

Area of Focus	Ongoing Actions	Actions Started
7. Demonstrating Leadership in Municipal Processes and Collaborations	12	10 (83%)
8. Adapting and Making London More Resilient	2	2 (100%)
9. Advancing Knowledge, Research and Innovation	1	1 (100%)
10. Measuring, Monitoring and Providing Feedback	12	11 (92%)
Total	**62**	**58 (94%)**

Note: 13 Ongoing Actions are scheduled to start in 2023 and 12 more in 2024.

Similar to Timeline Actions, those Ongoing Actions not started in 2022 will be prioritized in 2023 or 2024 based on the results of implementation planning and allocation of funding and/or resources to support the actions.

Indicators of Progress by Area of Focus

The workplans found within each CEAP Area of Focus identify over 100 potential indicators of progress that are intended to evolve throughout the CEAP implementation process and be used to characterize the progress towards CEAP goals. A subset of 66 of the initial 100 indicators represent the baseline data that is currently available to measure progress (Appendix A). The indicators highlight the impacts of CEAP actions and show progress towards 2030 Expected Results in the CEAP (Table 5).

In addition to the indicators included in the CEAP, measures that have been historically reported in the City's annual Community and Corporate greenhouse gas emission reports are being reported as part of CEAP progress reporting. These are also provided in Appendix A.

A detailed summary of CEAP actions status and progress, including specific examples for each Area of Focus, is included in the following sections of this report.

Table 5: Expected Results for 2030 as Identified in CEAP (April 2022)

Expected Result	Description
Walkable, Complete Neighbourhoods	Ensure Londoners can access nearby daily needs while reducing automobile dependence and improving equity.
Increased Active Transportation and Transit	Increase the viability and attractiveness of active transportation and transit to reduce automobile dependence, improve equity, and promote physical health.
More Zero Emission Vehicles	Reduce or eliminate fossil fuel use in vehicles.
More Net-zero Buildings	Improve energy efficiency and reduce or eliminate fossil fuel use in buildings.
Lower Carbon Construction	Reduce the use of construction materials with high lifecycle GHG emissions from raw material extraction to manufacturing and final

Expected Result	Description
	end-use/disposal. Design for less material use overall and utilize recycled products where possible.
More Resilient Buildings and Infrastructure	Build and maintain civic infrastructure and buildings to increase public safety and reduce unexpected and long-term cost burdens as a result of climate change.
More Carbon Capture	Protect, maintain, and improve London's natural heritage system, urban plantings and agricultural lands to reduce carbon in the atmosphere, support biodiversity, and reduce the effects of climate change.
Move Towards a Circular Economy	Support our economy's transition to reduced emissions from consumption and waste, more efficient material use, and the creation of regenerative prosperity.
Increased Community Resilience	Improve Londoners' ability to withstand, adapt, and recover from extreme weather events and other impacts of climate change.
Increased Engagement on Climate Action	Improve education, awareness and engagement to accelerate action on climate change by businesses, employees, community groups, institutions and individuals.

In Summary

Just over 90% of the CEAP's 2022 actions, both Timeline and Ongoing Actions, have been initiated by City staff or by organizations in London. Over 70% of the 200 CEAP actions have been initiated. Reporting on indicators of progress has started and will continue to grow as more and more data are compiled, reviewed and made available.

Engagement with City staff, external partners and interested parties will continue in 2023 and beyond to prioritize, resource and/or initiate remaining actions.

3.1. Engaging, Inspiring and Learning from People

Area of Focus 1 has nine actions focusing on engaging, inspiring and learning from people, two of which are Timeline Actions and seven are ongoing. Overall, eight of the nine actions have been initiated since the approval of the CEAP.

Total Actions	Timeline Actions	Timeline Actions Started	Timeline Actions Completed	Ongoing Actions	Ongoing Actions Started
9	2	2 (100%)	0 (0%)	7	6 (86%)

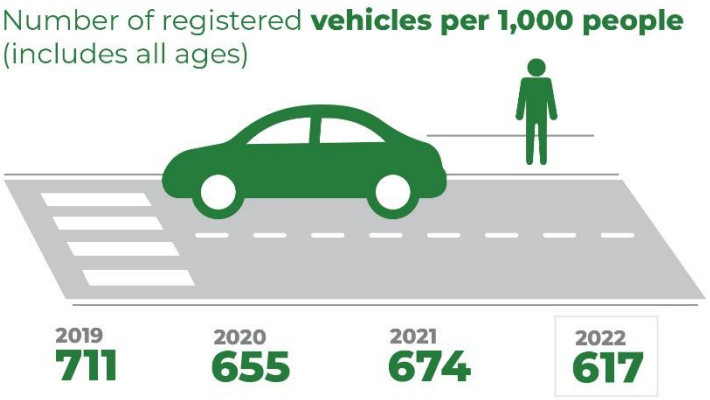
Highlights of work initiated and underway as part of Area of Focus 1 include:

- In 2022, all community advisory committees were evaluated and adjusted to better align with the 2021 City administration reorganization and establishment with new community advisory committee members. The CEAP is one focus of the Environmental Stewardship and Action Community Advisory Committee (ESACAC). ESACAC has been engaged to advise on implementation of the CEAP and has demonstrated its ability to carry issues from the public into the implementation process, as well as suggest and/or recommend methods and initiatives to share information with Londoners.

- City staff participated alongside four local community organizations to represent London as one of 19 communities across Canada in a federally funded initiative called the Tamarack Institute Community Climate Transitions Network. The focus of the 2022 cohort was to improve each community's understanding of Collective Impact (i.e., a desire or commitment from individuals or groups from different sectors to work together on a common plan using a collaborative framework) and jointly work towards aligning initiatives, efforts and resources towards the common goal of advancing climate action. This program resulted in strengthened ties with and among several local community organizations centred on climate action. It also advanced some of the individual outreach and engagement projects of each community partner. The community partners included the London Environment Network, Pillar Non-Profit's SDG Cities, ReForest London and Climate Action London. This work is continuing in 2023 with the addition of London Health Sciences Centre and the Middlesex London Health Unit as new organizations in the 2023 cohort.

- In 2022, the development and community engagement for the Mobility Master Plan (MMP) – a plan that will determine how London priorities transportation and mobility infrastructure, programs and policies for the next 25 years – was launched. The transportation system represents 40 per cent of community greenhouse gas emissions. Focusing and engaging in this area is key to the future success of CEAP:

    - The first phase of engagement for the MMP was designed to gather information about Londoners' experiences moving around the City. This engagement has occurred throughout 2022 and continued into early 2023 as the project moves to the second of three phases. The information obtained provides an improved understanding of what the community cares about, the challenges that exist, and what the community wants out of a transportation and mobility system.



See Appendix A for more performance indicators

    - To initiate research using a community-informed approach, the City began working with Community Connectors (i.e., individuals with diverse backgrounds, networks and skillsets, who speak multiple languages), City of London Anti-Racism and Anti-Oppression Community Liaison Advisors and multi-disciplinary staff. This team

integrated census data and advice from various experts in transportation and mobility as part of the process to develop a robust outreach list and strategies to reach people from equity-denied communities, varying geographies and socio-economic backgrounds.
    - To help connect low-income Londoners to the MMP engagement, City staff from Life Stabilization conducted targeted outreach to our active Ontario Works caseload through email blasts, a link to the MMP survey in staff signature blocks, and MMP posters at all Ontario Works front counters advertising the MMP engagement.
    - Further details on engagement and the MMP can be found in Area of Focus 4 (Transforming Transportation and Mobility)

- The Green in the City event series, delivered by the London Public Library, London Environmental Network and the City of London, changed its delivery format by moving to a different location across London for each event. This increased accessibility for those wishing to attend in-person. The event series started in November 2022 and ended in April 2023. CEAP was a key theme for each event.

- Preliminary conversations on CEAP were held with the Chippewas of the Thames First Nation (COTTFN) including a focus on the use of the Climate Lens Framework with respect to landfill gas collection, conversion to renewable natural gas, and the role of the future Green Bin program.

- The development and community engagement for Council's 2024-2027 Strategic Plan started in late 2022. Climate action, adaptation, sustainable development, resilience, sustainable transportation and mobility, were items being raised by the community and brought to Council's attention directly or through City staff reports and presentations.

- Several community engagement events and initiatives were completed since the approval of the CEAP in April 2022, including the engagement of some groups new to City outreach efforts (e.g., PROBUS club). City staff participated in over 25 events or meetings where a CEAP presentation was delivered or CEAP materials were displayed to encourage conversation and engagement on climate action. These in-person and remote meeting efforts resulted in the engagement of over approximately 600 people. The climate action display at the London Home Builders Association (LHBA) Lifestyle Home Show in January, 2023 was available for the roughly 10,000 attendees to view and engage with staff. Estimates suggest that between 20% and 25% spent time in this display area.

- London's Get Involved website for the CEAP (https://getinvolved.london.ca/climate) is the main location for online engagement and information for Londoners. There are numerous reports, videos, links and graphics available for those interested in climate action. The content was updated in 2022 to reflect the launch of the CEAP. The most popular documents downloaded in 2022 were:
    - Climate Emergency Action Plan full report (827 downloads by 493 unique visitors),
    - Community Energy Use & Greenhouse Gas Emissions Inventory (2020) (347 downloads by 164 unique visitors),
    - The Climate Emergency Action Plan - Actions at a glance (161 downloads by 122 unique visitors), and
    - Corporate Energy Consumption and Activities Report (2020) (138 downloads by 70 unique visitors);

- The City's communication outreach in 2022 was updated to integrate the CEAP into many areas, some of which included:
  - Creation of Climate Action at Home webpage (London.ca/climateaction) to promote available incentives, solar panel information, water conservation, emergency preparedness and flooding prevention. This page also highlights home energy efficiency opportunities that support local economic opportunities for businesses;
  - Updated information on CEAP in the climate change (how can we become more sustainable and resilient) six page section of the 2022-2023 Waste Reduction & Conservation Calendar delivered to over 120,000 households.
  - Several CEAP highlights and updates provided in the CityGreen publication delivered to over 80,000 homes and businesses and placed on-line at the CityGreen page on the City's website.
  - National Tree Day promoted the tree giveaway and pick up as part of London's climate action to advance tree planting and enhance natural heritage;
  - Forestry webpages on London.ca were recreated to reflect climate action messages;
  - Brochures and promotional material about stormwater and basement flooding were updated to reflect the increasing severity of extreme weather; and
  - The fats, oils and greases (FOG) cup, a popular solution that has been available for Londoners to manage FOG and keep it out of sewers, was updated with information about climate action and the CEAP.

3.2. Taking Action Now

Area of Focus 2 has 18 actions focusing on taking action now (household actions), six of which are Timeline Actions and 12 are ongoing. Overall, 16 of the 18 actions have been initiated since the approval of the CEAP.

Total Actions	Timeline Actions	Timeline Actions Started	Timeline Actions Completed	Ongoing Actions	Ongoing Actions Started
18	6	5 (83%)	0 (0%)	12	11 (92%)

Highlights of work initiated and underway as part of Area of Focus 2 include:

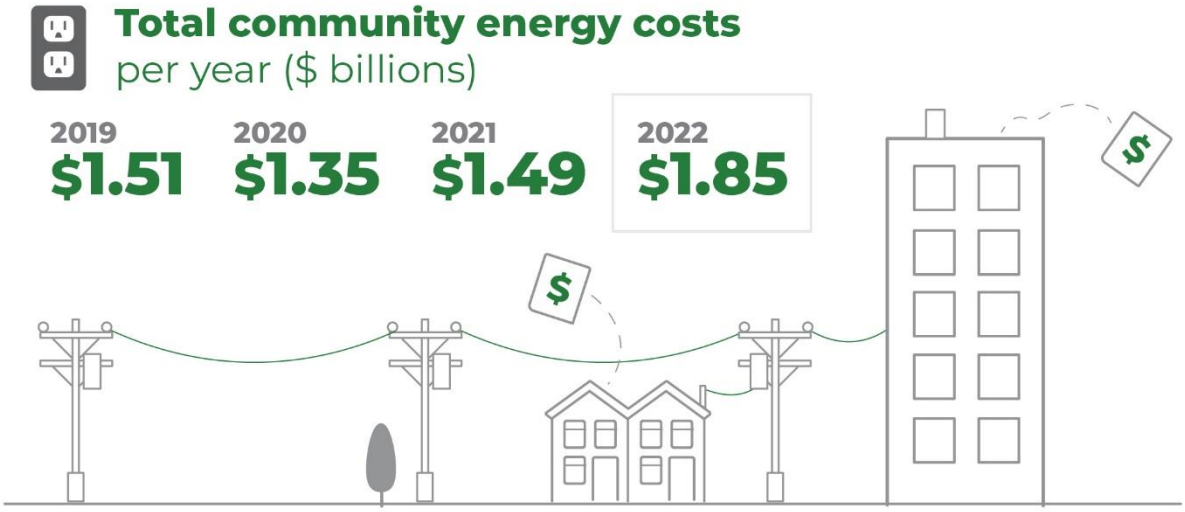
- The City of London supported the London Environmental Network's development and implementation of their Greener Homes London energy retrofit program. This support included a $400,000 investment from the London Community Recovery Network funding stream to support a resilient, equitable, and inclusive post-pandemic future. This initiative demonstrates that climate action strategies can help to achieve - instead of competing with - local economic priorities through co-benefits and create a greener, more resilient city for all. Overall, the LEN expects to see more projects, jobs, funds and resources allocated to the local retrofit sector which will support a sustainable and inclusive economic recovery that helps to meet local climate action targets.

- The City has supported the development and promotion of Project Neutral, a personal carbon footprint calculator. Project Neutral has evolved to add more technical support for identifying and tracking emission reduction actions and the introduction of new programs

like “Talk Climate To Me”, a women-focused initiative to improve the collective understanding and improve conversations on climate change.

- In partnership with MyHeat, the City launched MyHeat Solar, an online application available to Londoners to identify the financial and environmental benefits solar panels would have on their roof. The MyHeat Solar tool is an important first step for any Londoner curious about the feasibility and potential costs and benefits of rooftop solar panels for their home.

- London is one of seven municipalities Canada-wide participating in the Canadian Home Builders’ Association (CHBA) project - Towards Cost-Effective Net-Zero Energy Ready Residential Renovations. This CHBA project will provide training to local renovators to safely renovate homes to net-zero ready levels of performance. The CHBA project also involves the selection of up to 20 homes in London to be retrofitted to net-zero energy ready standards as per the CHBA’s Net Zero Home Labelling Program requirements. Participant selection will take place in late 2023 and retrofit activity would take place in 2024.



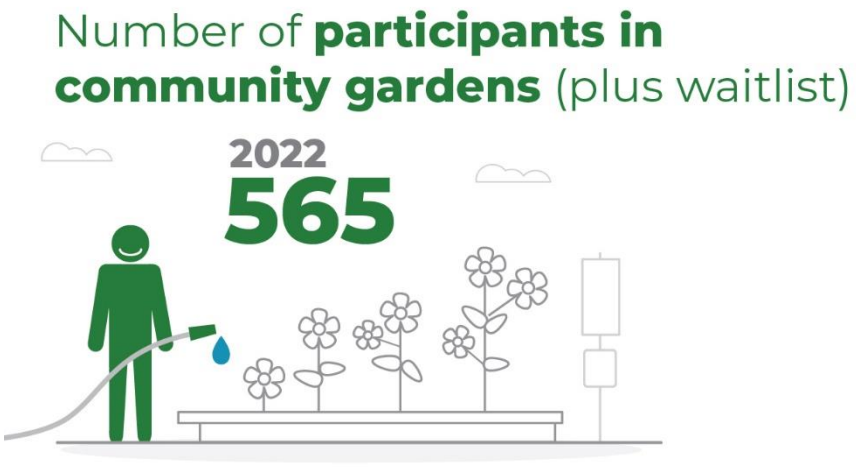
See Appendix A for more performance indicators

- City staff have collected and provided a wide array of information for Londoners interested in taking climate action at home on the City website at https://london.ca/climateaction. The Climate Action at Home webpage includes links to incentive programs to financially assist those looking to take action, best practices for energy efficiency upgrades at home, tips and recommendations for improved resilience to extreme weather, and links to other sources of information and tools to assist Londoners on their climate action journey.

- City staff provided support for Enbridge Gas to promote their hybrid heating pilot that replaces older central air conditioning units with air-sourced heat pumps, using intelligent controls to improve and optimize the use of zero-emission heating in combination with existing high-efficiency gas furnaces. The program was sold out with 100 installations in London and led to the larger, Province-led Clean Home Heating Initiative which expanded to four cities in Ontario (including London).

- City staff from Planning and Economic Development, Environment and Infrastructure, and Finance Supports are working collaboratively to review and provide options to reduce, restrict, or phase out fossil fuel using landscaping equipment (e.g., lawnmowers, trimmers, leaf blowers) by completing a study of best practices, applicable legislation and jurisdiction, costs and benefits, potential incentive programs, and other factors. A report to Council on this initiative is anticipated in late 2023.

- Community organization efforts to engage Londoners with the CEAP have progressed, including a collective action project from Climate Action London, Pillar Nonprofit Network, ReForest London and the London Environmental Network called “CONNECT with London’s Climate Plan”. This community initiative is focused on encouraging interested Londoners to content within the CEAP and to join Facebook groups related to reducing emissions at home, reducing emissions in daily life and helping protect and restore nature.



See Appendix A for more performance indicators

3.3. Transforming Buildings and Development

Area of Focus 3 has 22 actions focusing on transforming buildings and development, 19 of which are Timeline Actions and three are ongoing. Overall, 13 of the 22 actions have been initiated since the approval of the CEAP.

Total Actions	Timeline Actions	Timeline Actions Started	Timeline Actions Completed	Ongoing Actions	Ongoing Actions Started
22	19	11 (58%)	1 (5%)	3	2 (67%)

Highlights of work initiated and underway as part of Area of Focus 3 include:

- City Council approved a revision to the existing minimum parking standards in the Zoning By-Law to use an open parking standard (i.e., means there is no maximum or minimum requirements for the number of parking spaces for a development) through most of the city and significantly reduce the minimum parking space requirements in other areas (i.e., reduced to approximately 50% of the previous minimum parking requirements). In addition, revisions to the parking standards included the separation of bike parking requirements from personal vehicle parking stall quantities. These changes to parking standards for developments enable the reduction in the amount of land required for parking in private developments which supports increased uptake of active and public transit modes of transportation.

See Appendix A for more performance indicators

- The City's Planning and Economic Development Service Area has initiated the "Rethink Zoning" process to update the existing Z-1 Zoning By-law to reflect what is stated in The London Plan (i.e., the City's official plan). The process includes the evaluation and use of climate change considerations that relate to energy use, natural heritage protection, transportation options, and resilience to extreme weather and heat. The consulting team working with City staff on the draft by-law includes members of PosadMaxwan, a leading sustainable urban design and strategy consultancy based in the Netherlands, providing sustainable development input to the process. The first draft of the updated by-law is anticipated to be presented for consultation in the third quarter of 2023.

- An enterprise-wide group of City staff are working with a consulting team to update and revise the Site Plan Control By-law and Design Manual, which are foundational documents that guide the requirements for development across the city. This process includes the application of a Climate Lens Framework to the By-law and proposed revisions to ensure that they reflect the ambition and commitment of Council to address climate change.

- A review of existing Community Improvement Plan Programs has been initiated by City staff in Planning and Economic Development which includes the evaluation of potential additions and/or revisions to support building energy efficiency upgrades and resilience measures.

3.4. Transforming Transportation and Mobility

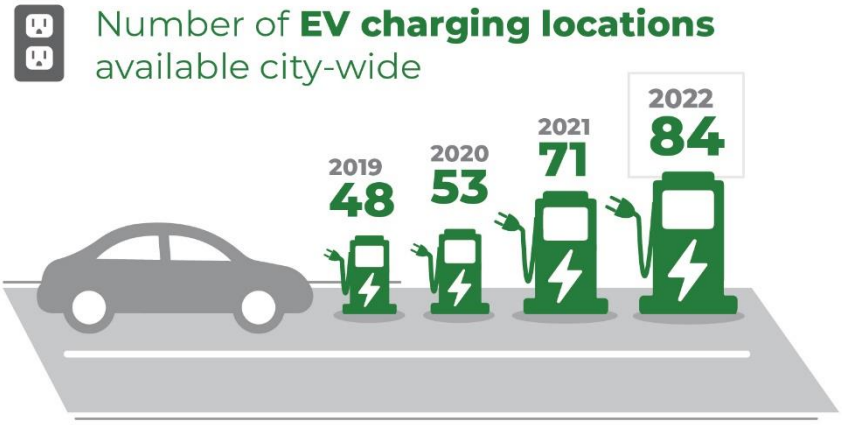
Area of Focus 4 has 30 actions focusing on transforming transportation and mobility, 22 of which are Timeline Actions and eight are ongoing. Overall, 26 of the 30 actions have been initiated since the approval of the CEAP.

Total Actions	Timeline Actions	Timeline Actions Started	Timeline Actions Completed	Ongoing Actions	Ongoing Actions Started

30	22	18 (82%)	1 (5%)	8	8 (100%)

Highlights of work initiated and underway as part of Area of Focus 4 include:

- Community engagement for the Mobility Master Plan is well underway. Highlights of participation as of April 2023 include more than 1,700 feedback forms received, more than 1,000 one-on-one conversations, more than 90 pop-up events attended throughout the city, and more than 1,700 Community Conversation webinar views to-date: Key themes raised included:
  - Transit reliability
  - Affordability
  - Pedestrian connectivity and sidewalk conditions
  - Cycling connectivity
  - Road safety
  - Accessible transportation
  - Road congestion
  - Personal safety, racism and discrimination
  - Accessing daily needs



See Appendix A for more performance indicators

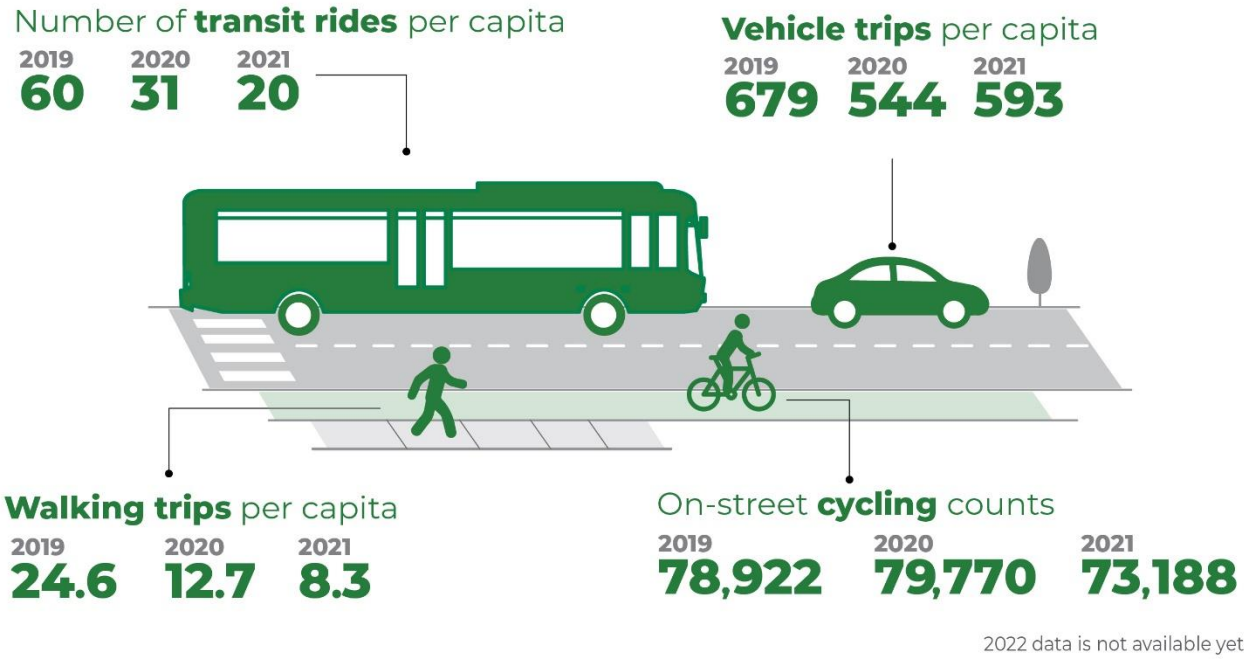
- The City joined the Province of Ontario's pilot program to test the use of personally-owned e-scooters on London's roads and multi-use pathways. City of London by-laws have been updated to permit their use.

- The City joined the Province of Ontario's pilot program to test the use of personally-owned cargo e-bikes (i.e., e-bikes that weigh more than 55 kilograms) on London's roads and multi-use pathways. City of London by-laws have been updated to permit their use. Programs to govern the use of commercial cargo e-bikes will be developed later in 2023.

- The City has prepared a Draft Connected and Automated Vehicle (CAV) Plan that will support the City in its efforts to help London prepare for the arrival of connected and automated vehicle technology, including the role of zero emission vehicles. This plan is being submitted to Council for approval in late May or June 2023.

- The City completed its pilot project testing the use of bike lockers, both short-term hourly rentals and monthly rentals. Locker usage rate changed throughout the pilot, averaging 85 rentals per month in 2022 compared to 17 in 2021.

- London's Rapid Transit infrastructure program is proceeding as planned, with construction started on all three of the approved segments of the network. The Downtown Loop is over 40% complete, the East London Leg is roughly 15% complete and work as begun on the Wellington Gateway segment. Work on each segment includes efficiency gains through coordinated infrastructure renewal for services requiring upgrading as they approach their end of service life.



See Appendix A for more performance indicators

3.5. Transforming Consumption and Waste

Area of Focus 5 has 21 actions focusing on transforming consumption and waste as part of the circular economy, 19 of which are Timeline Actions and two are ongoing. Overall, 18 of the 21 actions have been initiated since the approval of the CEAP.

Total Actions	Timeline Actions	Timeline Actions Started	Timeline Actions Completed	Ongoing Actions	Ongoing Actions Started
21	19	16 (84%)	0 (0%)	2	2 (100%)

Highlights of work initiated and underway as part of this Area of Focus include:

- Blue Box transition from the existing shared responsibility model (i.e., industry and taxpayers share in the cost) into a producer-led responsibility model (i.e., industry pays the majority of recycling costs), often referred to as 'full' or 'extended producer responsibility'

(EPR) will begin in London and area starting July 1, 2023 along with several other areas of Ontario. Producer responsibility helps to promote waste diversion; ensures costs of managing products and packaging at their end-of-life is handled by producers, saves taxpayers money and gives producers incentive to redesign products and make them easier to recycle. Preliminary estimates suggest that between $1.5 million and potentially in excess of $4 million per year in 2026 could be saved in London.

- Food waste avoidance (reduction) is a key priority within Area of Focus 5. Recent work has been underway in the following areas:
  - Academic research and pilot projects (with Western University) involving tools; techniques and other incentives to reduce residential food waste;
  - Waste composition studies that identify avoidable and unavoidable food found in the garbage bag; and
  - Financial quantification of the cost of waste food.

- As reported to Civic Works Committee in 2022 and early 2023 and covered by the media in London, the pandemic and ongoing supply chain issues has resulted in several delays in the delivery of collection vehicles required for both garbage collection and the upcoming Green Bin program. At the time of writing, the 26 trucks ordered in 2021 are expected to be received a few vehicles per month between May and November, 2023. Based on current information, City staff are now working on a Green Bin Program rollout schedule based on late fall/early winter start up. Further refinements to this timeframe will occur when the remaining truck build spots for 2023 are confirmed.

- The London Waste to Resources Innovation Centre is a collection of projects, pilot projects, research and policy analysis that focuses on many aspects of the circular economy. In 2022, the academic and research component, under the direction of Professor Franco Berruti, continued as part of the NSERC Industrial Research Chair in Thermochemical Conversion of Biomass and Waste to Bioindustrial Resources Western University. This Chair was developed to tackle the challenges of waste generation by increasing resource recovery opportunities and moving towards a circular economy, aiming at a zero-waste with zero greenhouse gas emissions from the waste sector. The research focuses on the development of innovative and practical solutions to turn items that are usually sent to disposal into valued resources.

- A report entitled Climate Change and Waste Management (focus on renewable natural gas - RNG) was prepared by City staff in 2022. The report focused on different combinations on waste management activities organized into the following five options (the first of which being the current system) to determine which option may have the greatest climate change benefit:

  1. Without Green Bin and with current landfill gas (LFG) management (flaring landfill gas)
  2. Green Bin with aerobic composting and LFG flaring
  3. Green Bin with anaerobic digestion (AD) with biogas upgrading and LFG flaring
  4. Green Bin with aerobic composting and LFG upgrading to RNG
  5. Green Bin with AD with biogas upgrading and LFG upgrading to RNG

  At the request of the Chippewas of the Thames First Nation (COTTFN), this report was peer reviewed by GHD, a multi-disciplinary consulting firm. The additional work completed for this

report and the peer review confirmed that several technically feasible options exist to further reduce greenhouse gas emissions from organics in the existing waste management system. The analysis does show that additional greenhouse gas emission reductions could occur with the creation of RNG at the landfill.

Part of the Climate Lens Framework was used to guide the evaluation of potential waste and organics management options compared with the current option. The Climate Emergency Screening Tool (CEST) was customized to the needs and specific climate change considerations of waste management projects and programs for this analysis.

3.6. Implementing Natural and Engineered Climate Solutions and Carbon Capture

Area of Focus 6 has 15 actions focusing on implementing natural and engineered climate solutions and carbon capture, seven of which are timeline actions and eight are ongoing. Overall, seven of the 15 actions have been initiated since the approval of the CEAP.

Total Actions	Timeline Actions	Timeline Actions Started	Timeline Actions Completed	Ongoing Actions	Ongoing Actions Started
15	7	2 (29%)	0 (0%)	8	5 (63%)

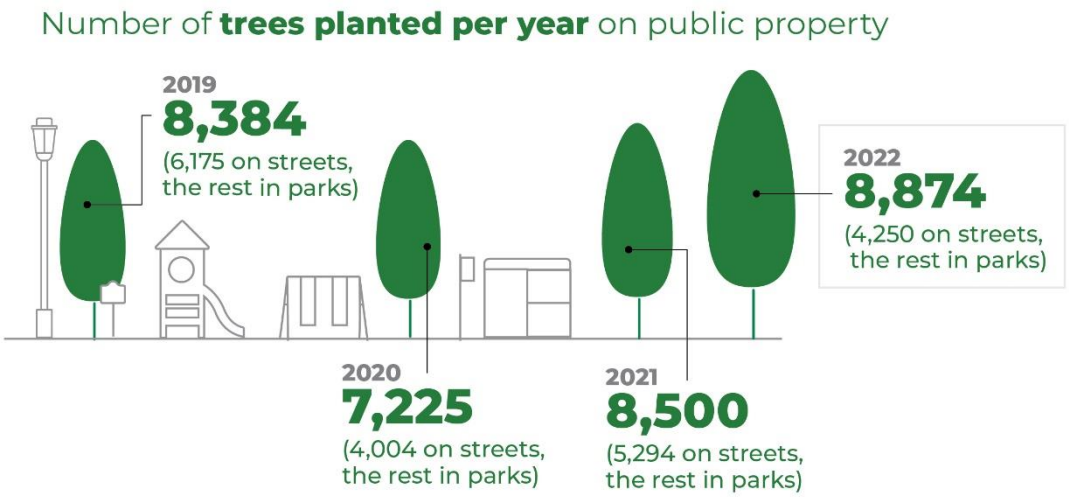
Highlights of work initiated and underway as part of Area of Focus 6 include:

- The City exceeded the target set for tree planting on City lands by 35% with over 37,000 trees planted from 2017 to 2021 while also reducing new tree mortality rates to within targeted levels over the same period. Over the same period, city-wide, Londoners planted the equivalent of 5.5 future forested Victoria Parks on private property each year, amounting to a total of approximately 180,000 trees planted during this period. Unfortunately, this fell short of the intended 247,000 trees required to be planted to stay on the correct trajectory to meet the Tree Planting Strategy canopy cover target of 34% by 2065.

- Updates to the Urban Forest Strategy and the Tree Planting Strategy were initiated in 2022 and are currently underway, with new tools and thinking embedded. The process to update these strategies will include consultation and engagement with internal and external parties focused on getting more trees planted and protecting London's existing urban forest.

- London's revised Environmental Management Guidelines (EMGs) were in force and effect as of 2022, which has provided clearer expectations for developers on natural heritage protection and accommodations for climate change priorities. The EMGs specifically note and acknowledge climate change action as a priority for the City of London and provide a policy trigger to integrate tools for climate change impact and opportunity assessment and subsequent establishment of requirements when they are developed in the future.

- Upper Thames River Conservation Authority is contracted to manage London's Environmentally Significant Areas (ESAs), which includes the expertise and training to respond to woodlot fires that are inaccessible to London Fire Department equipment.



See Appendix A for more performance indicators

3.7. Demonstrating Leadership in Municipal Processes and Collaborations

Area of Focus 7 has 44 actions focusing on demonstrating leadership in municipal processes and collaborations, 24 of which are Timeline Actions and 20 are ongoing. Overall, 25 of the 44 actions have been initiated since the approval of the CEAP.

Total Actions	Timeline Actions	Timeline Actions Started	Timeline Actions Completed	Ongoing Actions	Ongoing Actions Started
44	24	13 (54%)	0 (0%)	20	12 (60%)

Creation and implementation of the City's Climate Lens Framework has advanced since the approval of the CEAP, with many work groups within different City of London Service Areas using the approach to embed climate considerations into decision-making. Some notable projects and initiatives where portions of the Climate Lens Framework was or is actively being used include:

- Several road infrastructure projects, including the Windermere Road Improvements Environmental Assessment, the Adelaide Street North Environmental Assessment, and the funded sections of the Rapid Transit system.

- Evaluation of management options for source separated organics alongside landfill gas capture and use options for London's W12A landfill.

- Wastewater Treatment's Biosolids Management Master Planning exercise is nearing completion with climate impacts and the reduction of greenhouse gas emissions prioritized as key decision criteria. This effort includes the evaluation of potential management options, the relation of those options to other City services (e.g., solid waste management, source separated organics management), and the evaluation and minimization of emissions and climate risks.

- Advancement of the City's Corporate Master Accommodation Plan and Alternative Work Strategy. These projects are both underway and include climate lens input to ensure planning and evaluation processes account for climate change considerations.

- The Mobility Master Plan includes climate lens input throughout the process and engagement efforts with Londoners have included direct references and ties to the CEAP.

- ReThink Zoning efforts to date have included the consideration of climate change issues to ensure that City climate action directions and commitments are reflected in the new zoning by-law.

- A climate and environmental impact summary template has been developed for inclusion in Planning and Environment Committee reports by Planning and Economic Development staff tasked with the review of development applications. This step is the first towards applying a climate lens to development applications and the process is intended to be extended to the Subdivision Approvals process next.

In addition to the internal use of the Climate Lens Framework by City staff, representatives from other municipalities across Canada have reached out to learn about the process and how it may be used to inform similar processes in their jurisdictions. Outreach, discussions and information exchanges have occurred with representatives from Peterborough, Windsor, Kelowna, Sudbury, Edmonton, Owen Sound, and others. Furthermore, dissemination of information and training on London's Climate Lens Framework has occurred to enable peer learning through events or meetings led by the Clean Air Partnership and the Regional Public Works Commissioners of Ontario.

Other highlights of work initiated and underway as part of Area of Focus 7 include:

- Class Environmental Assessments of three of London's wastewater treatment plants were conducted to support the construction of increased resilience measures. Elevated flood mitigation berms and additional pumping capacity to ensure operation of the facilities could continue during high water events were evaluated in the process.

- A commitment to evaluate non-fossil gas solutions to power and heat new City facilities was demonstrated by Wastewater Treatment Operations when the design for the new Dingman Creek pumping station included the total avoidance of natural gas. As opposed to commissioning the installation of a new pipeline for natural gas to service the facility, the use of heat recovery from wastewater and ground sources supplemented by electric heat is being explored to provide the required heating capacity.

- The City of London commenced work to install ten Level 2 electric vehicle charging stations (20 charging ports) at the A.J. Tyler Operations Centre for use by future fleet electric vehicles. This work received $100,000 of funding from Natural Resources Canada's Zero Emission Vehicle Infrastructure Program.

- The City of London introduced six Toyota Prius Prime plug-in hybrid electric vehicles and one Polaris GEM light service vehicle into service with the municipal vehicle fleet.

- Corporate Asset Management staff are evaluating the Municipal Natural Assets Initiative approach to valuing ecosystem services and have taken a leadership role among peer municipalities on lifecycle management of urban trees and woodlands. Further incorporation of climate-related elements such as escalating carbon costs and potential elevated risks from extreme weather and heat are intended to be considered in future versions of the Corporate Asset Management Plan.

- The City's procurement group has embarked on establishing appropriate performance indicators and annual targets for the phased implementation of Sustainable Purchasing section of the Procurement of Goods and Services Policy. The first step for this effort was to join the Canadian Collaboration for Sustainable Procurement, which is expected to help staff's development of key performance indicators for sustainable procurement as well as be a source of information from other municipalities and supporting consultants on developing areas such as the circular economy.

- The Information Technology Services Division of the City is implementing an Alternative Work Strategy (AWS) that is centred around staff primarily working remotely. This AWS, along with a pilot project to introduce a City workspace that supports active transportation commuting and better hybrid meetings, reduces greenhouse gas emissions related to employee commuting.

3.8. Adapting and Making London More Resilient

Area of Focus 8 has nine actions focusing on adapting and making London more resilient to the impacts of climate change, four of which are Timeline Actions and five are ongoing. Overall, seven of the nine actions have been initiated since the approval of the CEAP.

Total Actions	Timeline Actions	Timeline Actions Started	Timeline Actions Completed	Ongoing Actions	Ongoing Actions Started
9	4	4 (100%)	0 (0%)	5	3 (60%)

In 2022, London partnered with ICLEI Canada (formerly International Council for Local Environmental Initiatives), to be part of a group with twenty other Ontario municipalities in the program called Advancing Adaptation. The program was designed to assist municipalities in the creation of a climate change adaptation plan by working through an industry-standard

framework called ‘Building Adaptative and Resilient Cities’ or BARC. The BARC framework is used internationally by many cities and has been used extensively by the Federation of Canadian Municipalities with several examples in Ontario.

This ongoing work builds upon the risk assessment work completed internally by the City of London in 2014 and includes collaborative planning on climate change adaptation action identification, implementation and monitoring. A working group attended two workshops early in 2022:

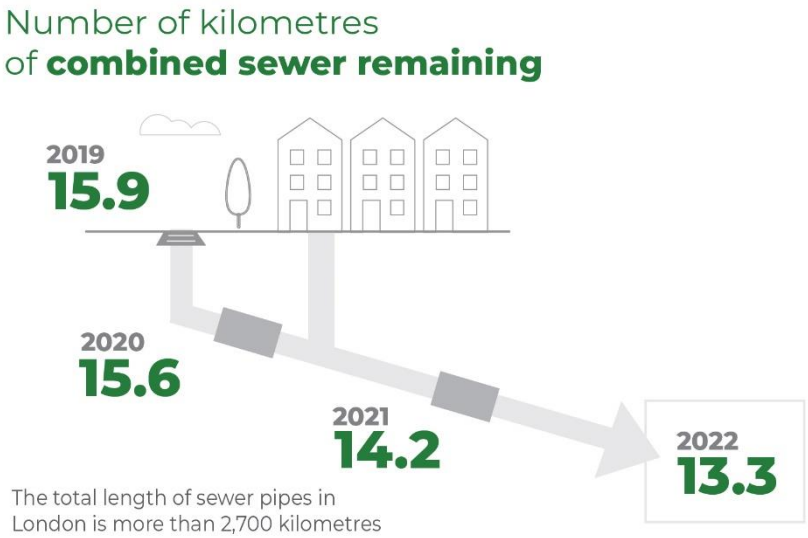
- February 9, 2022. The focus was on introducing actions that would address the risks of climate change in London; and
- March 8, 2022. The focus was on reviewing the actions and prioritizing and investigating who would lead and support the various actions.

Attendance included City staff from 15 divisions and community representatives arranged through the London Environmental Network. The overall focus for the working group and subsequent City staff efforts was to create a draft climate change adaptation document (“discussion primer”) for community engagement later in 2023.

Additional progress relating to improving London’s resilience to the impacts of climate change as part of Area of Focus 8 include:

- Federal funding from the Disaster Mitigation and Adaptation Fund (DMAF) was secured for the improvement of the Broughdale Dyke, which protects 190 properties north of downtown London from Thames River flooding (construction work to commence in 2023).

- DMAF-funded wastewater treatment plant adaptation infrastructure construction was completed at two of five plants. These infrastructure projects included the construction of earthen berms to protect the plants from floodwaters and the installation of lift pumps to ensure that treated effluent from the plant can still be discharged to the Thames River during high water events.



See Appendix A for more performance indicators

- Assembly of eighty 72-hour emergency preparedness kits for homeowners to have in the case of power outages and/or other weather-related emergencies was funded through ‘Strong Neighbours Campaign’ administered by ICLEI Sustainable Cities Canada. These kits will improve the resilience of homeowners, are supported by London’s Emergency Management team and were distributed by City staff during community engagement events.

- The Dingman Creek subwatershed Municipal Class Environmental Assessment is underway, which is evaluating a “complete corridor” approach as part of the EA process to promote the movement of stormwater, wildlife, and people. The recommended strategy is intended to be a showcase project for South London as well as a fiscally responsible approach to stormwater management in the subwatershed and consideration for future impacts from climate change.

- The Victoria Bridge replacement project on Ridout Street over the South Thames River included a design change to remove the centre support pillar. Since this concrete pillar is in the middle of the river and regularly traps floating debris, the elimination of this obstruction to allow free flow of the river is expected to reduce potentially dangerous blockages during flood events. Directly upstream, London Hydro has their equipment storage compound located within the floodplain thereby being flood susceptible in extreme events.

- The Emergency Management Team hosted a climate-focused emergency preparedness ‘mock emergency’ exercise at the Emergency Operations Centre. The full day session simulated a significant river flooding event and involved more than 100 personnel from 25 agencies and emergency organizations. An additional component was a live marine rescue operation held at Fanshawe Reservoir.

- Western University expertise in severe weather research and monitoring continues to grow with the announcement in 2022 of the Northern Hail Project which joins the Northern Tornadoes Project, founded in 2017. This expansion adds a team of researchers studying ‘hail climatology’ to their growing research facility that focuses on tornadoes and severe winds. Their research extends across Canada but directly benefits London by providing access to state-of-the-art information and expertise for community awareness and engagement. These Western researchers continue the wind engineering research work that began in 1965 with the construction of the Boundary Layer Wind Tunnel Laboratory and, more recently in 2014 with the launch of the Wind Engineering, Energy and Environment Dome (WindEEE Dome).

3.9. Advancing Knowledge, Research and Innovation

Area of Focus 9 has nine actions focusing on advancing knowledge, research and innovation, eight of which are Timeline Actions and one is ongoing. Overall, eight of the nine actions have been initiated since the approval of the CEAP.

Total Actions	Timeline Actions	Timeline Actions Started	Timeline Actions Completed	Ongoing Actions	Ongoing Actions Started
9	8	7 (86%)	1 (13%)	1	1 (100%)

Highlights of work initiated and underway as part of Area of Focus 9 include:

- The City of London and Western University signed a Memorandum of Understanding (MoU) intended to set out the mutual intentions of the City and Western to advance their

joint climate change mitigation and adaptation objectives. The MoU is based upon the mutual understanding that the combined expertise, influence, and commitment of the parties are better applied together to support their common goals. The MoU establishes set of principles for enhanced and focused coordination and collaboration to support their shared interests in climate change mitigation and adaptation.

- As part of CityStudio, City staff worked with faculty and students at Western University and Fanshawe College on projects related to carbon accounting, assessing walkability of neighbourhoods, and post-COVID employee commuting surveys for municipal governments.

- Additional student projects outside of the CityStudio program supported by City staff included the assessment of embodied carbon of construction materials (e.g., cement and concrete) used in the London area. This project was conducted by Western University Chemical Engineering students.

- City staff are working with researchers from Western University on a federally funded project for improved multi-scale greenhouse gas emissions modelling from urban environments to enhance mitigation strategies.

- City staff are working with researchers from the University of Waterloo, in partnership with the Federation of Canadian Municipalities (FCM) and ICLEI Canada, on a federally funded project for measuring and monitoring city and municipal level greenhouse gas emissions and mitigation effectiveness.

- City staff are working with a group of researchers from University of Waterloo on the "Residential development Impact Scorecard for the Environment" (RISE) project. It is an assessment tool and framework for carbon stock and greenhouse gas impacts of residential developments. It is a 5-year interdisciplinary research project funded through Environment and Climate Change Canada's Climate Action and Awareness Fund and involves three other Ontario municipalities, and representation from FCM, developers

See Appendix A for more performance indicators

(including London based, Sifton Properties), the building industry, professional planning and landscape architecture associations.

- The City has supported additional research projects at the funding stage, including the Towards Equity and Accessibility in Municipal Climate Action (TEAMCA) partnership led by Dr. Manuel Riemer and administered through Wilfred Laurier's Viessman Centre for Engagement and Research in Sustainability (VERiS). This partnership project builds on existing and creates new national and international networks to leverage an interdisciplinary and multisector team of academic and municipal leaders, social innovators, and representatives of equity-focused and municipally focused organizations. The intent of the partnership is to encourage greater organizational transformation needed for municipalities to practice equitable and accessible climate action.

3.10. Measuring, Monitoring and Providing Feedback

Area of Focus 10 has 23 actions focusing on measuring, monitoring and providing feedback on the CEAP, two of which are Timeline Actions and 21 are ongoing. Overall, 15 of the 23 actions have been initiated since the approval of the CEAP.

Total Actions	Timeline Actions	Timeline Actions Started	Timeline Actions Completed	Ongoing Actions	Ongoing Actions Started
23	2	1 (50%)	0 (0%)	21	14 (67%)

Highlights of work initiated and underway as part of Area of Focus 10 include:

- City staff completed reports for 2022 corporate and community greenhouse gas emissions. For more information see Appendices B and C.

- City staff worked with Corporate Knights to develop London's first high-level, consumption-based emissions inventory. Consumption-based greenhouse gas emissions refer to those created by providing products and services used by Londoners – from the raw materials to make these products through to their use. In technical terms this is referred to as Scope 3 emissions. These emissions are in addition to local greenhouse gas emissions that are a result of Londoners' and businesses direct use of energy. Summary information relating to consumption-based emissions in London is presented in Section 6.3 of this report and the analysis provided by Corporate Knights is provided in Appendix D.

- City staff worked with the London Community Foundation to incorporate climate and energy indicators into the 2022 Vital Signs Report and on-line reporting system called the Data Hub Data Hub — Be the Change (bethechangelondon.ca).

City staff have created a project management and tracking database to contain all implementation data related to the CEAP. The database includes each of the 200 CEAP actions, identifies the individuals within the City and the community who are advancing the actions, tracks individual implementation items (e.g., events, projects, studies, plans, etc.) and relates, where possible, the expected results and associated indicators to the Areas of Focus and actions.

As noted at the start of this chapter, the CEAP Areas of Focus reference a set of over 100 indicators of progress that are intended to evolve throughout the CEAP implementation process and be used to report on the progress towards CEAP goals. A subset of 66 of the initial 100 indicators represent the baseline data that is currently available to measure progress (Appendix A).

Collecting accurate data to support some Areas of Focus and Expected Results can be difficult and resource intensive. One such example is the collection of accurate data to determine the annual carbon sequestration of landscapes in London to inform the 'More Carbon Capture' Expected Result. While it would be ideal to have a detailed inventory of carbon sequestration capacity of all land in London to measure year-over-year progress, this would be costly. Alternative methods other than annual individual property assessment for sequestration capacity in vegetation, soil and other sources by a specialist(s) are currently being evaluated to determine the best data collection and/or estimation method.

Many existing City data collection systems can be relatively easily modified to capture new data that will inform CEAP progress. Work has started to incorporate key CEAP data into changes to internal Planning and Economic Development systems triggered by Bill 23 data and process requirements. The City's property information database system (AMANDA) and the processes by which data is added to the system through development and redevelopment activities are being modified to include data relevant to tracking climate action performance. Examples of this data include the number of net-zero and net-zero ready buildings being constructed (or retrofit), the units per hectare density of residential units in greenfield development, and the utilization of mass timber and/or low-carbon concrete in building construction.

Many of these indicators of progress have also been shared with the London Community Foundation for use on the Vital Signs Data Hub.

In future CEAP reporting, analysis of these data and their year-over-year trends will be possible to examine the level of progress that city-wide climate action efforts are achieving. In addition, new indicators will be added to support measuring those Expected Results that are currently underrepresented by quantitative data.

4. Progress on Climate Actions in the Community

What will I learn in Section 4?	You will learn about some of the actions being taken by Londoners and London's businesses and institutions to address climate change. One guiding principles of CEAP is to assist with alignment and collaborative approaches to implementing climate actions.
Why does Section 4 matter?	Climate actions undertaken by the City of London can only achieve so much on their own. Businesses and institutions are and will be playing a major role in climate action such as energy utilities, post-secondary education, large employers, and land developers. Small-to-medium sized business are often early adopters of innovation. Individuals, community associations and environmental organizations play a major role by providing inspiration as well as resources to help Londoners take action.
How can I take action?	Depending on your interest, you may wish to: • engage with existing organizations on projects and programs; • support community groups with in-kind services or financial donations; and /or • participate in community events.

The following sections provide a few recent examples of climate action and environmental sustainability in the sectors of Businesses and Institutions and Households, Individuals and Community Groups. The items in section 4.1 and 4.2 are in addition to what has been mentioned in sections 3.1 and 3.1. There are many more actions than these occurring in London or in other area that will influence what goes on in London.

The goal in 2023 and 2024 is to strengthen the ability to receive information on climate change actions and to let others know about climate actions being taken across London. The goals is to ensure that individuals, groups, businesses, institutions and organizations are recognized for the work being undertaken, encouraged to do more where possible, and to grow the overall numbers involve by demonstrating change is possible and doable in London.

4.1. Business and Institutional Sectors

In recent years, electricity conservation programs have been delivered at the provincial level by the Independent Electricity System Operator (IESO) through programs like Save on Energy. However, locally, London Hydro continues to support local climate actions, including:

- Hybrid Heat Pump Pilot – The London Hydro and Enbridge Gas hybrid heat pump pilot wrapped up in 2022 (further details provided on the next page under Enbridge). Due to its

initial success, the pilot program has been extended into 2023. The process of monitoring the technologies' effectiveness in Southwestern Ontario's climate has started.

- Green Button - Having been a lead partner in the worldwide development of the Green Button initiative since 2012, London Hydro was the first Ontario electric utilities to complete the certification for the Ontario Regulation 633/21 standard in 2022. Londoners continue to have access to standardized energy consumption and billing data to manage and make choices around their energy usage and electricity carbon footprint.

- Energy Conservation Resource Advocacy - London Hydro, through the Electricity Distributors Association and working with member utilities, led the 2022 provincial effort advocating for a return of electricity conservation resources to the local level. Conversations continue in 2023 with the IESO and the Ministry of Energy, with a core objective of creating resources locally that will ultimately support municipal climate emergency action plans province-wide.

- Zero Emission Bus Strategy - London Hydro continued to work with the London Transit Commission and their consultant throughout 2022 on the Zero Emission Bus Strategy offering feedback on charging infrastructure and connection to the distribution system.

- Public Electric Vehicle Charging - London Hydro's three curbside electric vehicle charging locations saw 1,741 charging connections across 2022 as electric vehicle adoption accelerates and the desire for public charging grows.

Enbridge Gas continues to be an active partner with the City of London on local climate actions. Bi-monthly meetings are held with Enbridge Gas and City of London staff to share updates on activities and explore opportunities for collaboration. The hybrid home heating pilot in London, in partnership with London Hydro, is one high-profile example of a project that originated from these regular meetings. Building on the success of the original London pilot, in September 2022, the Province of Ontario announced that it was providing up to $4.5 million through the Clean Home Heating Initiative to bring hybrid heating to up to 1,000 households in St. Catharines, London, Peterborough, and Sault Ste. Marie.

Enbridge's conservation programs, such as Home Efficiency Rebate Plus, Home Winterproofing, and Savings By Design for commercial buildings, form the backbone of many climate actions undertaken by Londoners and London businesses. Participants in the Savings By Design program in London include:

- Museum London retrofit measures achieved 15% greater than Ontario Building Code energy efficiency performance.

- RBC Royal Bank retrofit measures achieved 15% greater than Ontario Building Code energy efficiency performance.

- Drewlo Holdings retrofit measures at several condo/apartment buildings achieved 15% greater than Ontario Building Code energy efficiency performance.

- London Middlesex Community Housing recently reviewed energy performance measures to achieve ~27% greater than Ontario Building Code energy efficiency performance for a new community housing multi-residential building.

Sifton Properties' West 5 net-zero energy residential and commercial development continues to be built out, employing many innovations that are likely to become common as London strives for net-zero emissions by 2050.

Eve Park, being developed by S2E Technologies, is a new net-zero community being built adjacent to West 5. This includes an innovative car-share program as part of the development, where each parking garage will house electric cars that residents can book for use, for an hourly fee, through an app offered by Eve Park.

The London Chamber of Commerce 2022-2025 Strategic Plan notes "We can support our member's mandates and the public's demand for business action on environmental sustainability through policy development and educational resources for our members."

Western University has committed to reduce their greenhouse gas emissions by at least 45 per cent by 2030 from 2005 levels, and to achieve net-zero emissions for campus operations by 2050. As part of Western's emission reduction plans, a district energy loop is being implemented on campus. The chilled water network is being upgraded so it can operate year-round and allow for the sharing of excess energy between buildings. New buildings and retrofits through Western's Deep Energy Retrofit Program (DERP) are being designed to integrate with the energy loop and are resulting in about 60 to 80 per cent reduction in greenhouse gas emissions. Western's campus also has 13 Leadership in Energy and Environmental Design (LEED®) certified buildings, which include features such as: bird-safe windows, native plant and no-irrigation landscaping, low-flow water fixtures, EV charging stations, green roofs, rooftop solar, local building materials, high-efficient LED and occupancy-sensor lighting, and high-performance windows.

In 2022, Western University was ranked #1 in Canada for its work toward the United Nations Sustainable Development Goals and #3 in the world based on research, stewardship, outreach and teaching.

Fanshawe College's Greenhouse Gas Reduction Roadmap and Action Plan has set the goal to reduce the college's greenhouse gas emissions by 30 per cent below 2013 levels by 2030 and by 80 per cent by 2050. Fanshawe's GHG Reduction Strategy involves four key elements: conservation and demand management, space optimization and net zero buildings, fleet and facility electrification, and renewable energy.

London Health Sciences Centre (LHSC) provided a presentation to SPPC on February 7, 2023 on a master planning process for the lands located at Wellington Road and Commissioners Road. LHSC has started discussions with City staff regarding addressing CEAP's Area of Focus 3, Transforming Buildings ad Development, as part of this overall project.

Goodwill Industries will lead the implementation of the Circular Economy Work and Training Platforms Program to help grow social enterprise by creating living wage skilled jobs and training opportunities for vulnerable and marginalized populations disproportionately impacted by COVID-19, and to improve environmental impacts in the textile industry.

Anderson Craft Ales received federal government funding to buy and install carbon capture technology to replace the carbon dioxide normally purchased to help carbonate their beer. This new technology gives Anderson the ability to capture and store the carbon dioxide created during fermentation and add it back to the beer, meaning it is not released. The equipment is expected to capture and reuse more than 45 tonnes per year of carbon dioxide.

Langs Bus Lines is starting the process of converting about half its 400-vehicle school bus fleet to electric school buses.

United Parcel Service (UPS) Canada has converted 25 vans in its London location to run on CNG, supported by an agreement between Enbridge Gas affiliate Union Energy Solutions Limited Partnership, and Clean Energy Fuels Corp.

Northern Commerce, a London tech firm, provided e-bikes to all their staff. The company's senior vice president decided to gift the e-bikes to his team to share his passion for e-bikes as a key tool for replacing vehicle trips to help fight climate change, and also as a 'thank you' gesture for their staff.

Green Economy London has grown to 65 members – the fastest growing Green Economy Hub in Canada. Activities in 2022 included:

- Awarded four Green Project Support grants to members ($2,500 each) to assist in implementation of sustainability projects;
- Facilitated employee engagement activities including Workplace Green Up and Green Wheel (employee commuting);
- Launched the EV Charger Incentive Program; and
- Awarded Green Leader Awards to the London & District Construction Association, Play Away Indoor Park, Heeman's, and Graphenstone.

4.2. Individuals, Households and Community Groups

In terms of actions taken by individual and households, a few statistics include:

- 316 households signed up for Enbridge Gas's hybrid home heating (heat pump) pilot project and the follow-up Clean Home Heating Initiative.

- 1,158 households completed home energy retrofits in 2022 using incentives from Canada Greener Homes and/or Enbridge Gas.

- 8.1% of new vehicles registered in London in 2022 were low-emission vehicles; 4.9% were gas-electric hybrid vehicles and 3.2% were zero emission vehicles.

- The Loewen-Nair household entered in 2022 and won Canadian Geographic's inaugural Live Net Zero challenge, with a grand prize of $50,000 for their actions that included using moving from the suburbs into central London to reduce the need for driving, using e-bikes for daily transportation, and switching to a heat pump for space heating.

The London Environmental Network (LEN), with its 46 members, carried out 40 projects in 2022, including:

- Greener Homes London, including becoming an EnerGuide Audit service organization;
- The Environmental Action Incubator which supports six community projects per year;
- Green Infrastructure program, which includes projects that naturalize urban spaces to improve local stormwater management and biodiversity;
- Clean Energy in Remote & Rural Communities: Deshkan Ziibiing Retrofit Pilot Program;
- EcoLeaders: Youth Environmental Leadership Program;
- Residential Rain Garden Pilot; and
- Nonprofit Resiliency Project.

With funding from the London Community Recovery Network (LCRN), LEN will accelerate building retrofits carried out by businesses and residents through its programs, Green Economy London (GEL) and Greener Homes London (GHL). Examples of building retrofits include switching to energy-efficient or renewable energy options for heating/cooling and appliances, improving insulation and ventilation systems, and other resource-saving improvements in existing buildings.

A number of metrics contained in LEN's 2022 Annual Report include:

- Annual communication reach has increased from 10,315 in 2020 to 18,141 in 2022;
- 176 environmental events were listed on the Events Calendar, mainly coming from member events;
- More than 3,000 individuals engaged on Greener Homes London through outreach booths, webinars, workshops and group presentations; and
- 4,305 residents educated about greenhouse gas emissions, water and waste reduction through the Environmental Action Incubator;

ReForest London, a not-for-profit organization with the mission to plant and protect trees through community partnerships and education in London achieved significant milestones through its programs in 2022, including:

- Park Naturalizations: With the help of 958 volunteers, 4,052 woody plants were planted in London's parks, totaling 1,489 volunteer hours. The City of London, foundations, private enterprise, and community organizations were crucial partners in this endeavor.

- Neighbourhood ReLeaf: Over 2,018 trees were distributed to 1,072 households in London, beautifying neighborhoods and benefiting the environment. Government entities, foundations, private enterprises, and community organizations supported this program.

- Trees for Teachers: Ten schools participated, engaging 273 students in seedling workshops and tree planting. Students planted 50 trees and sowed 80 seeds in schoolyards. Government support, along with foundations, private enterprises, and community organizations, contributed to the success of this program.

Climate Action London, a not-for-profit community group and member of the London Environmental Network, has hosted free environmental-themed film screenings, co-hosted Earth Fest and climate march activities in downtown London and hosts the London chapter of Greening Sacred Spaces. Greening Sacred Spaces is an initiative of Faith & the Common Good (a national, interfaith network and registered charity) and is focused on inspiring, educating and engaging with faith communities in London to embrace London's CEAP in their communities and places of worship.

Urban League of London, representing 20 Neighbourhood Organizations and 19 Community Organizations, helped to share environmental and climate change information and continued its major award programs:

- The Green Brick Award to recognize an outstanding built form project in the city, usually where the development has engaged citizens at both the planning bd development stages of the projects. This award has been given since 1984; and

- The Green Umbrella Award to recognize an individual, or occasionally to an organization, demonstrating outstanding community citizenship and leadership in London, as evidence by a significant body of work. It recognizes the efforts of residents working to improve the lives of fellow Londoners. This award has been given since 1975.

Planning for the 2nd annual EarthFest started in the fall of 2022 and was delivered on April 22, 2023. It was led by numerous community groups (e.g., Reimagine Institute for Community Sustainability, Climate Action London, London Environmental Network) and individuals and represents the largest environmental and climate change event in London.

5. Progress on Climate Actions with Other Levels of Government

What will I learn in Section 5?	You will learn that about actions taken by other levels of government and at the international level that have direct or indirect influence on climate actions in London. Actions on climate change are generally aligned; however some actions cause an increase in greenhouse gas emissions due to other priorities.
Why does Section 5 matter?	Many climate policies at the provincial and federal government levels have a direct impact on Londoners, ranging from how electricity is generated through to incentives offered to retrofit buildings and to purchase zero-emission vehicles. Understanding where climate policies are not aligned helps to understand why progress in some areas may be slower than expected or desired.
How can I take action?	Depending on your interest, you may wish to: • engage directly with different provincial ministries such as the Ministry of Environment, Conservation and Parks or Ministry of Energy; • engage directly with Environment and Climate Change Canada or Natural Resources Canada; and/or • read about and act on initiatives offered by other levels of government that support individuals, households, businesses and institutions.

5.1. Provincial Government

The CEAP supporting document, Overview of Provincial Climate Change Actions, provides background information on the provincial government's climate policies and actions. This section provides an update on actions that were taken in 2022.

For electric vehicles, the provincial government in partnership with the federal government has focussed its efforts on attracting investments in the electric vehicle supply chain. Recent announcements by Stellantis, a Netherlands-based automaker, and Volkswagen to invest billions of dollars into battery and electric vehicle manufacturing facilities in Brampton, Windsor, and St. Thomas. The provincial government has also made announcements supporting exploration for critical minerals such as nickel, copper, cobalt, and lithium.

The provincial government is also providing $91 million to help add more EV chargers across Ontario, including highway rest stops, carpool parking lots, Ontario Parks, and in community hubs like hockey arenas and municipal parks. The province also introduced the Rural Connectivity Fund to provide rural municipalities the opportunity to apply for provincial funding to support the installation of EV chargers in their communities.

As noted earlier, the provincial government provided up to $4.5 million through the Clean Home Heating Initiative to bring hybrid heating to up to 1,000 households in St. Catharines, London, Peterborough, and Sault Ste. Marie.

In the last couple of years, greenhouse emissions from Ontario's electricity grid have started to increase due to the cancellation of renewable power generation projects, resulting in an increasing reliance on natural gas fuelled power plants that have increased grid-related emissions. Greenhouse gas emissions from Ontario's electricity grid are forecasted to climb even further this decade – up to 300% higher than 2018-2019 levels in the upcoming 2025-2030 period. This issue has been raised by over 30 Ontario municipalities, who asked for the provincial government to phase-out gas-fired power generation by 2030. The IESO was asked to study this, and they reported back in October 2022 that this timeline was not feasible. However, the Ontario Minister of Energy has asked the IESO to report back on a moratorium on the procurement of new natural gas generating stations and to develop an achievable pathway to zero emissions in the electricity sector in Ontario.

The Province of Ontario committed in 2022 to updating floodplain mapping by convening a Flood Mapping Technical Team comprised of staff from related natural resource ministries, AMO, municipalities, and conservation authorities. This group provided recommendations to the Minister of Northern Development, Mines, Natural Resources and Forestry. This team then took advantage of partnering opportunities with the federal flooding initiative (FHIMP) described below.

5.2. Federal Government

The CEAP supporting document, Federal Government – Climate Change Information, Roles and Responsibilities, provides background information on the federal government's climate policies and actions.

The federal government's carbon pricing policy will be the largest contributor to greenhouse gas emissions this decade. With carbon prices increasing to $170 per tonne by 2030, many actions that may not be cost effective today may become cost-effective later this decade. With the Climate Action Incentive, those households that do take action or already have a low-impact lifestyle will get more money back through this incentive than the carbon price they paid on the fuels they use.

In March 2022, the federal government launched consultations to develop Canada's Clean Electricity Regulations and drive progress towards a net-zero electricity grid by 2035. This will likely influence, and be influenced by, Ontario's plans for the electricity sector in Ontario, which are currently forecasting higher grid emissions by 2035 compared to 2018-2019 levels.

The federal government's Budget 2022 recapitalized the Zero Emission Vehicle Infrastructure Program with an additional $400 million, and extended the program to March 31, 2027, complemented by $500 million that Canada's Infrastructure Bank will invest in large-scale ZEV charging and refuelling infrastructure.

In April 2022, the federal government's Incentives for Zero-Emission Vehicles (iZEV) Program increased the manufacturer's suggested retail price (MSRP) maximums, which increased the number of makes and models of eligible vehicles. The definition of longer-range plug-in hybrid

vehicles (PHEVs) was also changed to be based on electric range in kilometres. PHEVs with an electric range of 50 kilometres or more will be eligible for $5,000, and those under this threshold will continue to be eligible for $2,500.

In June 2022, the federal government issued their Clean Fuel Regulations that require producers and importers of gasoline and diesel to reduce the carbon intensity of their fuels from 2016 levels starting in July 2023, with deeper annual reductions through to 2030. The regulations create a credit market for compliance, which allows those not subject to the regulations (like EV charging stations) to participate. This is expected to encourage further deployment of EV charging stations, particularly Level 3 fast charging stations at existing gas stations with convenience stores.

In June 2022, the federal government also established a Greenhouse Gas Offset system for activities not covered by carbon pricing. At present, the system only covers landfill methane recovery (above and beyond regulatory requirements), but protocols are being developed for agriculture, forest management and halocarbons. Work is also underway to develop protocol requirements for direct air carbon capture and sequestration related projects as well as looking into ways to remove barriers and enhance participation in the system by Indigenous people.

In September 2022, the federal government released Canada's Methane Strategy. The government estimates that it can cut methane emissions by more than 35 per cent below 2020 levels by 2030, which is higher than the global pledge. This strategy will also look at improving methane measurement and reporting, which is an important consideration for the City of London's active and closed landfill sites.

In late 2022, the federal government announced its collaboration with Enbridge Gas for the joint "one window" delivery of home energy retrofit incentives through the revised Home Efficiency Rebate Plus program that combines the offerings of the Canada Greener Homes (up to $5,000) with Enbridge Gas' offering (also up to $5,000). This "one window" approach reduces the paperwork burden for homeowners undertaking home energy retrofits.

In May 2022, the Flood Hazard Identification and Mapping Program (FHIMP) was announced that has allocated $63.8 million to map flood hazards in high-risk areas. Within that amount, $7.6 million was identified for Ontario to cost share for high priority locations. This was part of a larger $145.5 million to increase resiliency to natural hazards.

On November 24, 2022, "Canada's National Adaptation Strategy: Building Resilient Communities and Strong Economy" was released. It established a national vision using five areas (called pillars) that each have a federal lead department; disaster resilience, health and well-being, the natural environment, infrastructure, the economy, and workforce. While the effects of more extreme weather, slow onset climate changes, and cascading impacts will pose a significant risk to physical infrastructure, it has also been identified as an important sector for climate resilience potential, as measured by the proportion of damages that can be avoided through robust climate change adaptation.

A short-term outcome (2023 to 2028) of the National Adaptation Strategy is a commitment to long-term stable funding for climate resilience and adaptation (as evidenced by Disaster Mitigation and Adaptation Fund (DMAF) used in several infrastructure projects described above).

5.3. International

The results of international efforts to address climate change were presented in the recent release of the Intergovernmental Panel on Climate Change (IPCC) Synthesis Report for the Sixth Assessment Report (AR6) in March 2023. The overarching conclusions of the approved Summary for Policymakers includes headline statements regarding the (A) current status and trends; (B) future climate change, risks and long-term responses; and, (C) responses in the near term. The headline statements include the following:

- (A.1 Observed Warming and its Causes) "…Global greenhouse gas emissions have continued to increase, with unequal historical and ongoing contributions arising from unsustainable energy use, land use and land-use change, lifestyles and patterns of consumption and production across regions, between and within countries, and among individuals."

- (A.3 Current Progress in Adaptation and Gaps and Challenges) "Adaptation planning and implementation has progressed across all sectors and regions, with documented benefits and varying effectiveness. Despite progress, adaptation gaps exist, and will continue to grow at current rates of implementation. Hard and soft limits to adaptation have been reached in some ecosystems and regions…"

- (B.1 Future Climate Change) "…Deep, rapid, and sustained reductions in greenhouse gas emissions would lead to a discernible slowdown in global warming within around two decades, and also to discernible changes in atmospheric composition within a few years."

- (C.1 Urgency of Near-Term Integrated Climate Action) "Climate change is a threat to human well-being and planetary health. There is a rapidly closing window of opportunity to secure a liveable and sustainable future for all. Climate resilient development integrates adaptation and mitigation to advance sustainable development for all and is enabled by increased international cooperation including improved access to adequate financial resources, particularly for vulnerable regions, sectors and groups, and inclusive governance and coordinated policies. The choices and actions implemented in this decade will have impacts now and for thousands of years."

Many countries around the world are prioritizing climate action through energy and land use policy changes, the allocation of funding to sustainable development and a clean energy transition and through supporting climate actions by organizations like the United Nations, World Wide Fund for Nature, and the World Meteorological Organization. Not all climate actions by other countries will directly affect London or even Canada; however, the activities of Canada's closest neighbour and largest trading partner, the United States, are very likely to affect Londoners and all Canadians.

US Inflation Reduction Act
On August 16, 2022, United States President Joe Biden signed the Inflation Reduction Act (IRA) into law, marking the most significant action US Congress has taken on clean energy and climate change in the nation's history. The Act includes roughly $USD 400 billion committed to a clean energy transition and climate action. More specifically, the IRA aims to

catalyze investments in US manufacturing capacity, encourage procurement of critical supplies domestically or from free-trade partners (like Canada), and accelerate research and development and commercialization of cutting-edge technologies to combat climate change like carbon capture and storage and clean hydrogen.

The IRA is expected to have significant influence on Canadian climate policy, including the new climate action measures announced in the federal government's Budget 2023 (as discussed in Section 5.2 of this report). Businesses in Ontario that participate in the US market, such as the automotive sector and the EV supply chain, will likely be positively impacted by an increased demand for goods and services. The CEAP actions relating to advancement of the circular economy should be positively affected by the influence of the IRA on continental and international markets.

United Nations Environment Programme
According to the United Nations Environment Programme (UNEP), "since its inception in 1972, [it] has been the global authority that sets the environmental agenda, promotes the coherent implementation of the environmental dimension of sustainable development within the UN system and serves as an authoritative advocate for the global environment". Canada joined the United Nations in 1945.

UNEP employs seven interlinked subprogrammes for action: Climate Action, Chemicals and Pollutions Action, Nature Action, Science Policy, Environmental Governance, Finance and Economic Transformations and Digital Transformations.

In 2015, the UN adopted the Sustainable Development Goals (THE 17 GOALS | Sustainable Development (un.org)) as a call-to action for governments, businesses, institutions and people worldwide to address five critical areas of importance by 2030: people, planet, prosperity, peace and partnership. The agenda targets multiple areas for action, such as Climate Action, Sustainable Cities and Communities, Responsible Consumption and Production and Life of Land, and plans to build up local economies while addressing people's social needs.

United Nations Biodiversity Conference
From December 7 to 19, 2022 in Montreal, Canada, governments from around the world came together to agree on a new set of goals to guide global action through 2030 to halt and reverse nature loss. Of the four goals and 23 targets agreed to in the landmark UN Biodiversity Agreement (referred to now as the "Kunming-Montreal Global Biodiversity Framework (GBF)"), the following are likely to have at least some impact on Canada and Southwestern Ontario residents and/or businesses, specifically:

- Effective conservation and management of at least 30% of the world's lands, inland waters, coastal areas and oceans, with emphasis on areas of particular importance for biodiversity and ecosystem functioning and services.
- Cut global food waste in half and significantly reduce over consumption and waste generation.
- Prevent the introduction of priority invasive alien species, and reduce by at least half the introduction and establishment of other known or potential invasive alien species.
- Require large and transnational companies and financial institutions to monitor, assess, and transparently disclose their risks, dependencies and impacts on biodiversity through their operations, supply and value chains and portfolios.

The Kunming-Montreal GBF is expected to have significant influence on Canadian environmental policy, which may then influence federal-provincial agreements regarding measures for restoring biodiversity that may otherwise fall under provincial constitutional jurisdiction over “natural resources”.

Task Force on Climate-Related Disclosures

The international Financial Stability Board (FSB), which includes Canadian membership (Governor of the Bank of Canada, the Associate Deputy Minister Department of Finance and the Office of the Superintendent of Financial Institutions), published their 2022 TCFD Status Report: Task Force on Climate-related Financial Disclosures in October 2022.

The FSB’s TCFD released recommendations providing a framework for companies and other organizations to develop more effective climate-related financial disclosures through existing reporting processes. Uptake of these recommendations was reportedly on the rise leading up to 2022, with more urgent progress needed.

According to the TCFD, 80% of companies disclosed in line with at least one of the 11 recommended disclosures, however only 4% disclosed in line with all 11. Several industries reportedly have average disclosure levels across the 11 recommended disclosure of more than 40%, including energy companies (43%), materials and buildings companies (42%), banks (41%), and insurance companies (41%).

The acceptance and use of the recommendations of the TCFD in financial reporting is significant to Canadian and London businesses because in the 2022 budget, the Canadian Federal Government committed to mandating companies to report climate-related financial risks. The implementation began with Crown corporations with more than $1B in assets having to release their climate disclosures in 2022 and all other Crown corporations are expected to report according to the TCFD framework by 2024.

Public sector compliance timelines have not yet been established; however, the International Sustainability Standards Board (ISSB) reportedly made its final decisions on all content of its initial standards, with issuance expected in mid-2023. The Canadian Sustainability Standards Board (CSSB) is reportedly being formed with a mandate to develop and support the adoption of international sustainability standards in Canada.

6. Greenhouse Gas (GHG) Emissions

What will I learn in Section 6?	You will learn about the amount of greenhouse gas emissions generated in London and those emissions that specific to City of London operations. You will also be introduced to greenhouse gas emissions that are generated as a result of consuming goods and products from other parts of the world.
Why does Section 6 matter?	Reducing London's local greenhouse gas emissions to net-zero emissions by 2050 is one of the three main goals of the CEAP. Providing the latest information on progress towards this goal helps to assess where the City of London and Londoners are doing well and where more effort is needed. Greenhouse gas emissions in other parts of Canada and the rest of the world associated with Londoner's consumption of goods and services are not included within reduction targets set by cities like London. These emissions can be larger than local emissions.
How can I take action?	Depending on your interest, you may wish to: • become more knowledgeable on what an individual, household, business or not-for-profit can do to reduce greenhouse gas emissions; and/or • share your knowledge and experience with making more sustainable choices.

6.1. Scope 1 and 2 GHG Emissions

Scope 1 emissions are direct greenhouse (GHG) emissions that occur from sources that are controlled or owned by Londoners and London businesses (e.g., emissions associated with fuel combustion in furnaces and vehicles) here in London. Scope 2 emissions are those associated with purchased or acquired electricity, steam, heat, and cooling. The Climate Emergency Action Plan's goal to achieve net-zero emissions by 2050 focusses on Scope 1 and 2 emissions.

Scope 1 and 2 greenhouse gas emissions are what is traditionally reported by municipalities through programs such as the Federation of Canadian Municipalities' Partners for Climate Protection program and global programs such as CDP Cities and the Global Covenant of Mayors.

6.1.1 Corporation of the City of London

Current corporate energy-related emissions have been influenced by the existing 2019-2023 Corporate Energy Conservation and Demand Management (CDM) Plan approved by City Council in 2018.

The Corporation of the City of London reports on energy-related greenhouse gas emissions on an annual basis (The latest information that is available is for 2022. For more information on

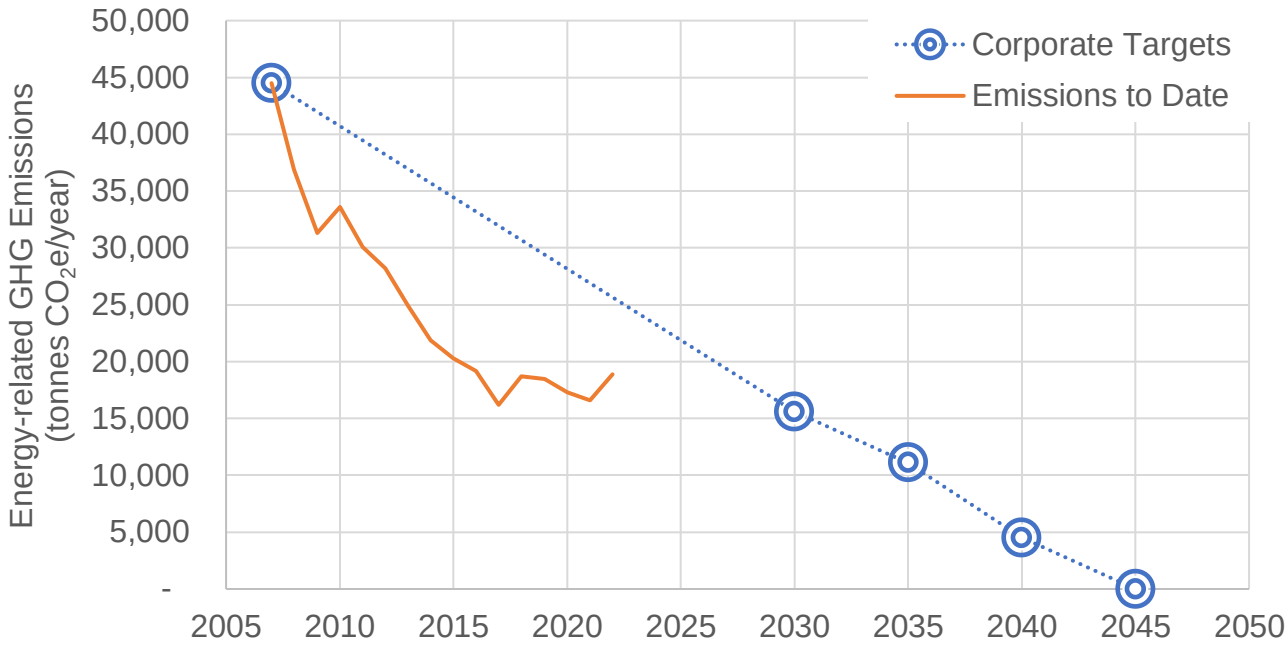
corporate energy use and greenhouse gas emissions, please refer to the 2022 Corporate Energy Consumption Report in Appendix B.

In 2022, corporate energy-related greenhouse gas emissions were 18,900 tonnes of equivalent carbon dioxide. This is one per cent (200 tonnes) higher than 2018, but 58 per cent lower compared to 2007, as shown in Figure 1.

Figure 1). The latest information that is available is for 2022. For more information on corporate energy use and greenhouse gas emissions, please refer to the 2022 Corporate Energy Consumption Report in Appendix B.

In 2022, corporate energy-related greenhouse gas emissions were 18,900 tonnes of equivalent carbon dioxide. This is one per cent (200 tonnes) higher than 2018, but 58 per cent lower compared to 2007, as shown in Figure 1.

Figure 1 - Corporate Energy-Related Greenhouse Gas Emissions to Date Compared to Corporate GHG Emission Reduction Targets



(Source: City of London, 2022 Corporate Energy Consumption Report)

Most of the emission reductions since 2007 are due to a relatively cleaner electricity grid in Ontario, combined with increased energy efficiency and conservation efforts:

- 84% reduction in electricity-related emissions
- 46% reduction in steam-related emissions, due solely to corporate actions
- 33% reduction in natural gas related emissions, due solely to corporate actions

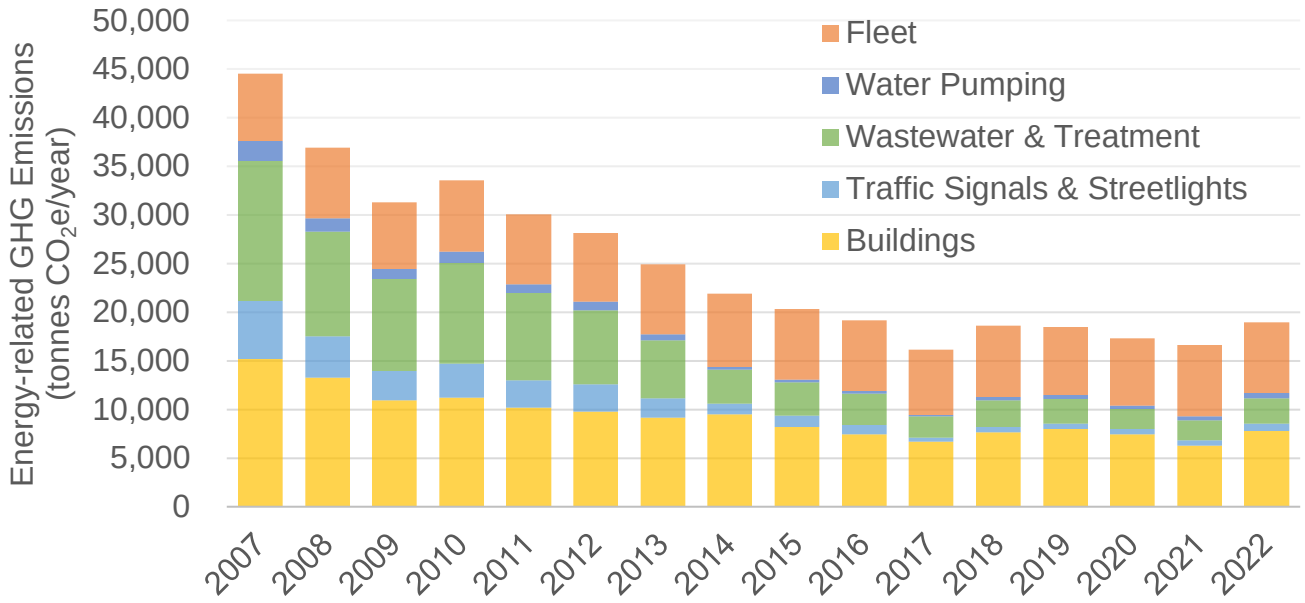
However, in the last couple of years, greenhouse emissions from Ontario's electricity grid have increased, from 30 grams equivalent carbon dioxide per kilowatt-hour in 2018 to 45 grams per

kilowatt-hour in 2022. Given that electricity represents 57 per cent of the energy used by the City, changes in Ontario's electricity grid will have an impact on energy-related emissions. As a result, the City's greenhouse gas emissions in 2022 are about 1,300 tonnes (seven per cent) higher than they would have been if Ontario's grid emissions had not changed.

Municipal buildings and fleet vehicles have the largest share of corporate energy-related emissions, as shown in Figure 2.

Emissions from waste management operations (e.g., methane from active and closed landfills) and wastewater treatment (e.g., nitrous oxide from sewage sludge incineration) are included within the community scale greenhouse gas emissions inventory as per the Global Protocol for Community-Scale Greenhouse Gas Emission Inventories (GPC).

Figure 2 - Corporate Energy-Related Greenhouse Gas Emissions since 2007 by Service Category

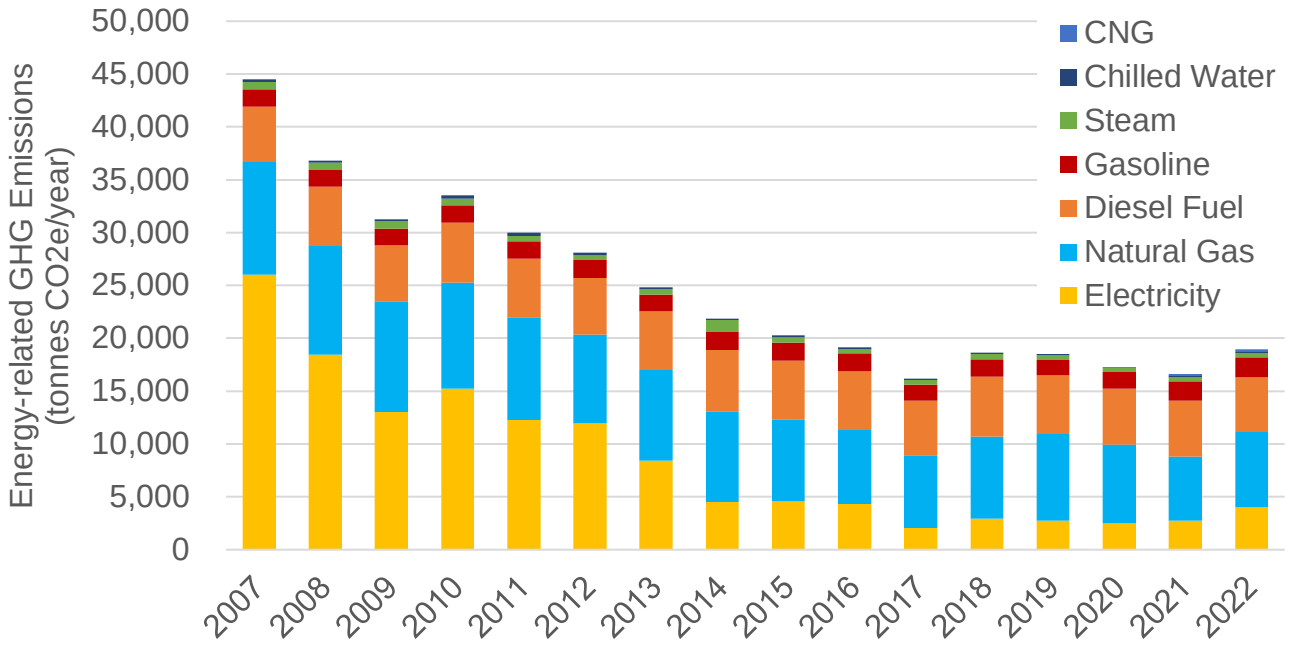


(Source: City of London, 2022 Corporate Energy Consumption Report)

From an energy commodity perspective, natural gas and diesel are our two largest sources of energy-related emissions. Measures to electrify building heating, reduce vehicle fuel use, and to use zero emission vehicles and fuels will be priorities.

However, as shown in Figure 3, electricity's share of greenhouse gas emissions is beginning to grow. Given that greenhouse gas emissions from Ontario's electricity grid are expected to climb even further this decade – up to the 80 to 90 grams per kilowatt-hour range in the 2025-2030 period – and that electricity is vital for many municipal services, direct investment in renewable electricity generation for municipal facilities may be needed to help meet our 2030 target.

Figure 3 - Corporate Energy-Related Greenhouse Gas Emissions since 2007 by Energy Commodity



(Source: City of London, 2022 Corporate Energy Consumption Report)

Even though emissions from waste management operations (e.g., methane from active and closed landfills) and wastewater treatment (e.g., nitrous oxide from sewage sludge incineration) are included within the community scale greenhouse gas emissions inventory as per reporting protocol, it is important to note that the Corporation of the City of London does have some control over these emissions. In the case of methane, these emissions are far higher than energy-related emissions:

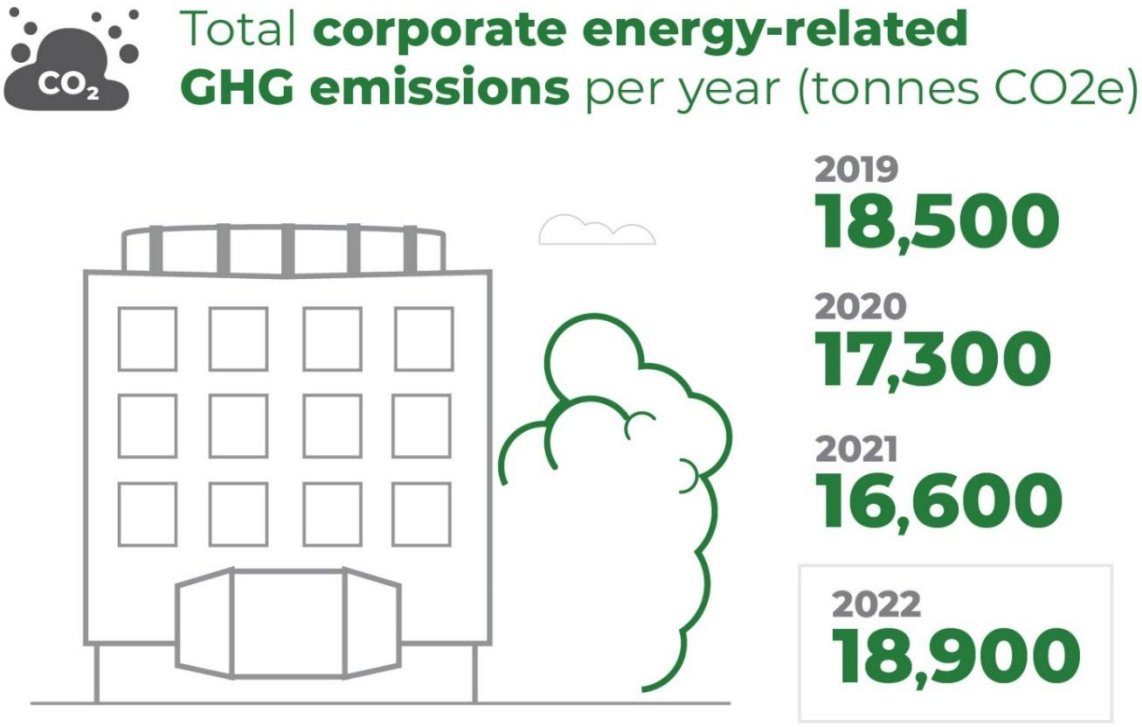
- W12A landfill – about 84,000 tonnes of equivalent CO_2e in 2022
- Closed landfills – about 31,000 tonnes of equivalent CO_2e in 2022
- Wastewater – about 8,000 tonnes of equivalent CO_2e in 2022

Whether corporate energy-related emissions stay on track to reach London's 2030 target depends upon the impact of corporate CEAP efforts, provincial and federal climate change policies (including incentives), and climate trends.

A summary of major trends influencing 2022 corporate greenhouse gas emissions are identified on Table . Compared to recent years, greenhouse emissions from Ontario's electricity grid increased in 2022. Given that electricity represents 57 per cent of all the energy used by the City, changes in Ontario's electricity grid will have a big impact on corporate energy-related emissions. As a result, the City's greenhouse gas emissions in 2022 are about 1,300 tonnes (seven per cent) higher than they would have been if Ontario's electricity grid emissions had not changed from recent levels.

Table 6: Summary of Major Trends and Occurrences in 2022 Influencing Corporate Greenhouse Gas Emissions

Positive	Unchanged or Unsure	Negative
• Total energy use was down 5.3% from 2018 levels, exceeding the 2019-2023 CDM Plan goals • Energy use by wastewater treatment operations was down 12% from 2018 levels • Diesel fuel consumption decreased by 11% from 2018 levels, due in part to switching 6 solid waste packers to CNG	• 4% decrease in building energy use due in part to pandemic work-from-home measures • Overall fleet emissions – reductions from reduced diesel use offset by increased gasoline use	• GHG emissions intensity of Ontario's electricity grid has increased • Energy used for water distribution has increased by 9% from 2018 levels due to equipment issues, which have been repaired • Increased number of rental fleet vehicles due to COVID-19 health requirements increased gasoline usage by 14% from 2018 levels



See Appendix A for more performance indicators

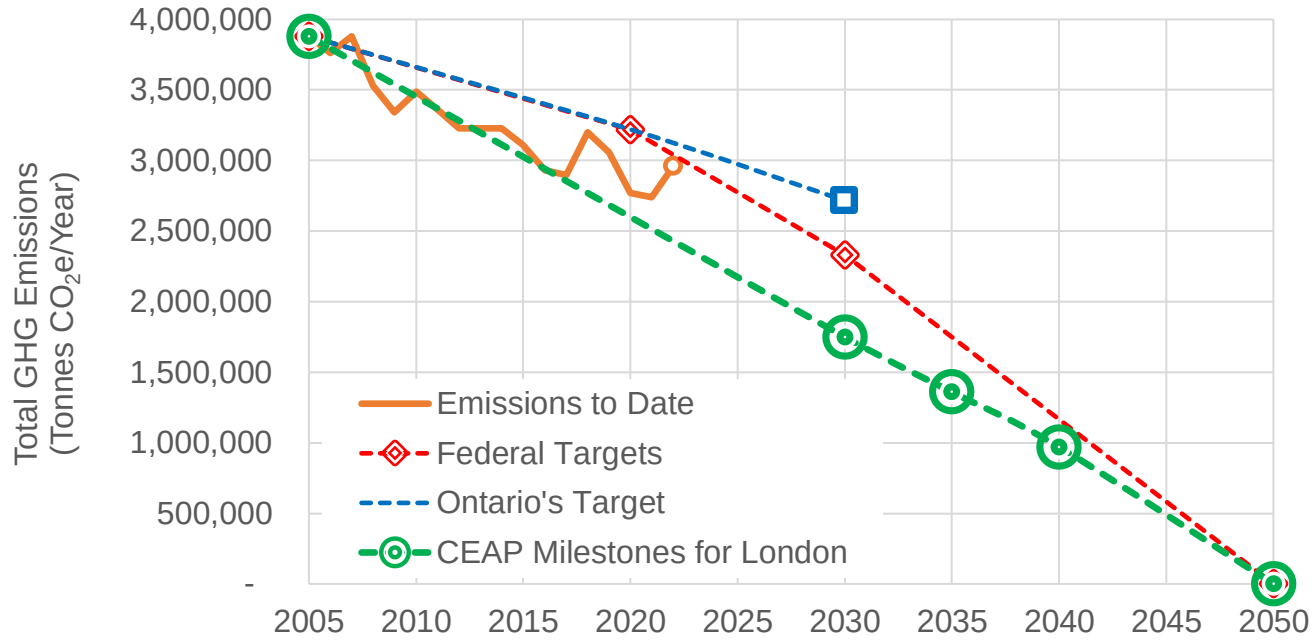
6.1.2 Community GHG Emissions in London

The City of London has been estimating community-wide greenhouse gas emissions as far back as 1990 and has been tracking emissions on an annual basis since 2004. The City of London follows the Global Protocol for Community-Scale Greenhouse Gas Emission Inventories (GPC). For more information on corporate energy use and greenhouse gas emissions, please refer to the 2022 Community Energy Use and Greenhouse Gas Emissions Inventory report in Appendix C.

Total greenhouse gas emissions in 2022 were 2.96 million tonnes of equivalent carbon dioxide. This is 24 per cent lower than 2005 levels, as shown in Figure 4. However, it is important to note the impact of the COVID pandemic on emissions.

Energy use is responsible for 95 per cent of all GHG emissions from human activity in London. Not only does burning fossil fuels such as gasoline, diesel, and natural gas produce carbon dioxide – the most common GHG associated with human activity – but the use of electricity also contributes to GHG emissions. The remaining five per cent come from methane emissions from landfills and nitrous oxides from wastewater treatment.

Figure 4 - Community Scale Emissions to Date Compared to Targets for London, for Ontario, and for Canada



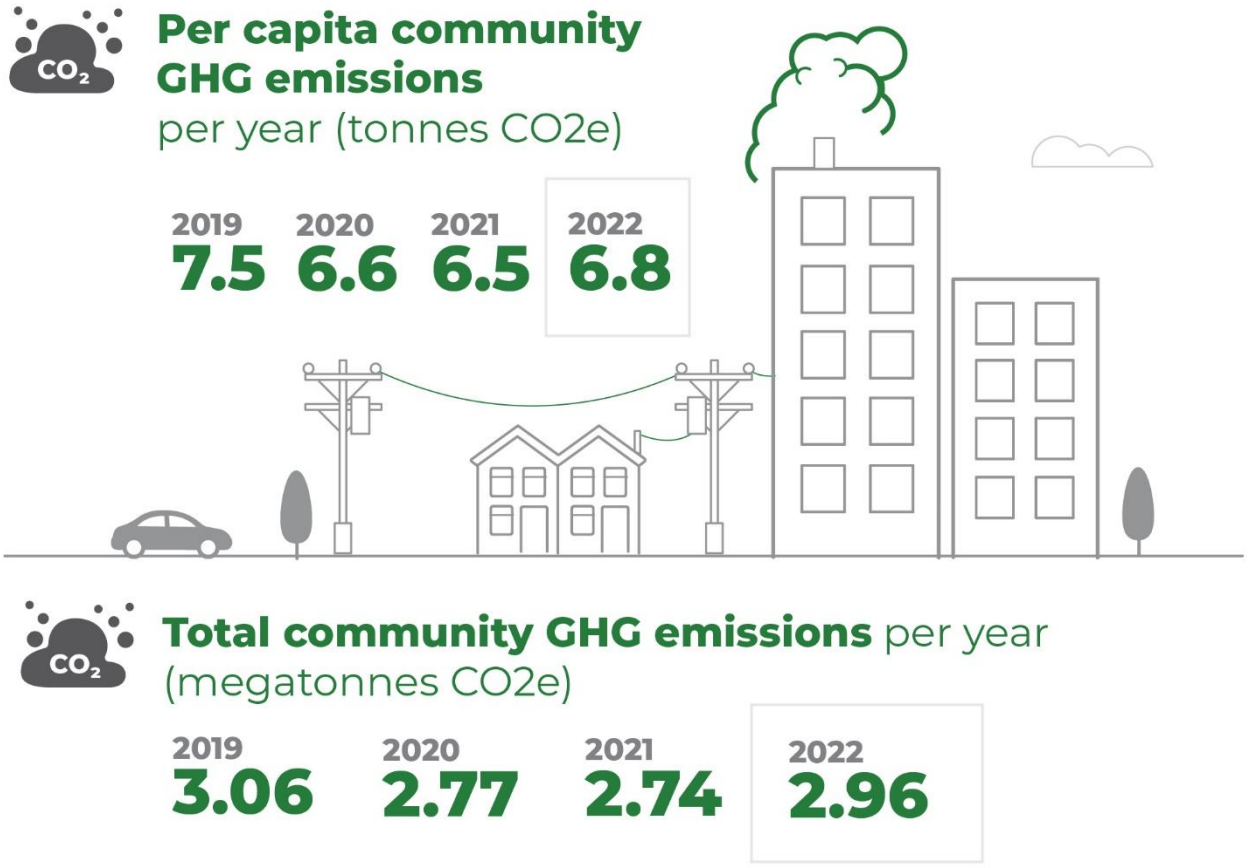
(Source: City of London, 2022 Community Energy Use and Greenhouse Gas Emissions Inventory)

About 90 per cent of Ontario's electricity was generated from emissions-free sources in 2022, such as nuclear and hydro-electric generating stations as well as renewable sources (wind and solar). However, Ontario still relied on fossil fuels such as natural gas to generate ten per cent of the electricity Londoners used in 2022, a higher share than in recent years. As a result, this increase in natural gas use for power generation is responsible for an additional 45,000 tonnes of emissions from London – 1.6 per cent higher.

Figure 5 illustrates the estimated breakdown of London's greenhouse gas emissions in terms of human activity, with half of the emissions coming from personal transportation and energy use at home.

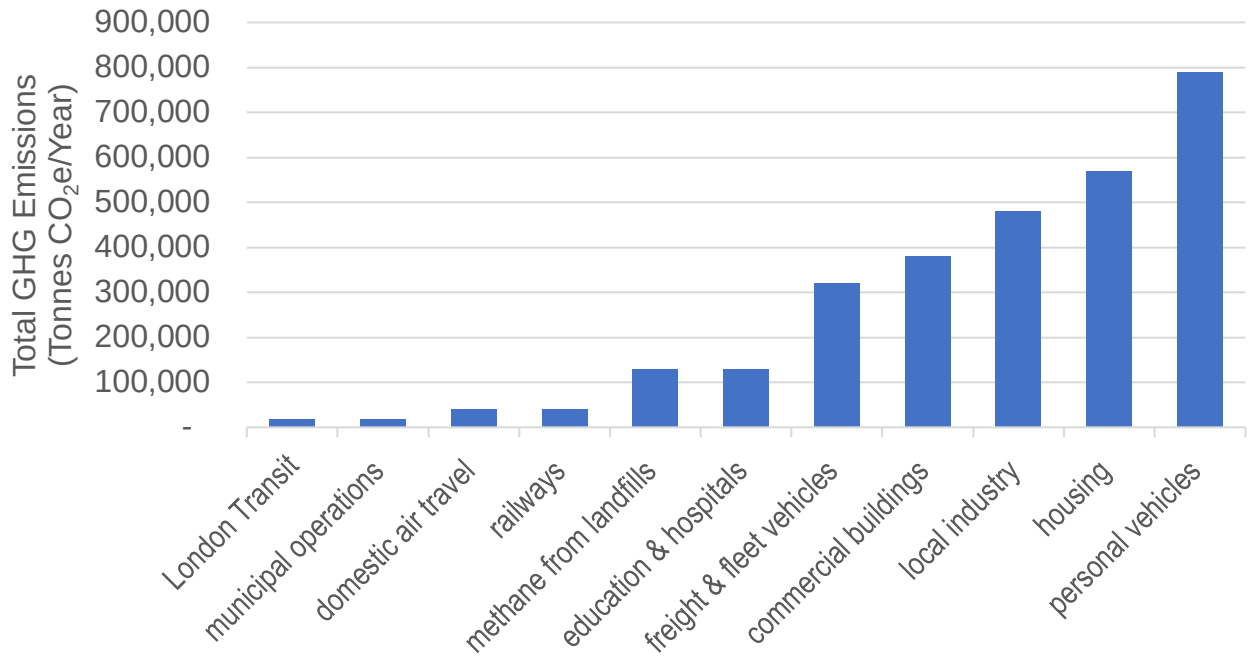
The COVID-19 pandemic continued to have a significant impact on transportation fuel use. Seasonal weather variations can affect energy use and associated emissions significantly. However, over the last ten years, winter average temperatures and most summer average temperatures have been warmer than normal.

As noted earlier, since 2005, there has been a downward trend driven by a combination of cleaner electricity generation and improved energy efficiency. However, since 2018, emissions have been above the trendline needed to meet our new science-based targets.



See Appendix A for more performance indicators

Figure 5 – 2022 Greenhouse Gas Emissions by Activity

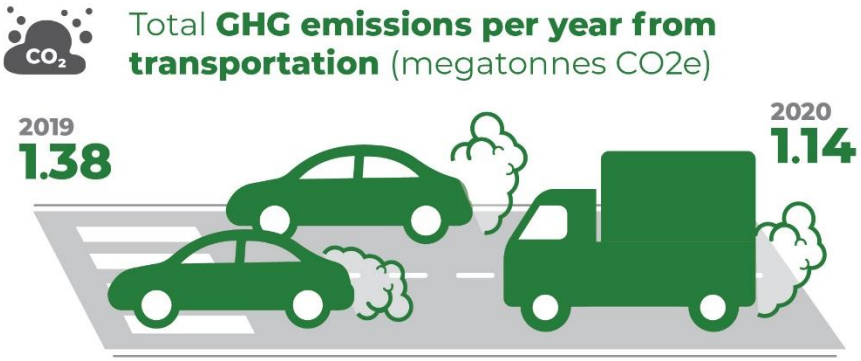


(Source: City of London, 2022 Community Energy Use and Greenhouse Gas Emissions Inventory)

The cancellation of provincial renewable electricity contracts and electric vehicle incentives may have contributed to the loss of momentum. As noted earlier, London's emissions in 2022 would have been 45,000 tonnes lower had the emissions intensity of Ontario's electricity grid remained unchanged.

For 2022 electric vehicle sales, as of the third quarter of 2022, Ontario's EV market share of 6.0 per cent was below the national average of 7.7 per cent and far behind British Columbia and Quebec at 15.6 per cent and 11.8 per cent respectively. London's EV market share is even lower, at 3.2 percent in 2022, due to the low availability of EVs in smaller markets like London.

Whether emissions continue to decrease depends upon the impact of energy and fuel conservation efforts, provincial and federal climate change policies (including incentives), climate trends, economic growth, and consumer choices. A summary of major trends influencing 2022 community



See Appendix A for more performance indicators

greenhouse gas emissions are identified on Table 7.

Ninety per cent of Ontario's electricity was generated from emissions-free sources in 2022, such as nuclear and hydro-electric generating stations as well as renewable sources (wind and solar). However, Ontario still relied on fossil fuels such as natural gas to generate ten per cent of the electricity Londoners used in 2022, a higher share than in recent years. As a result, this increase in natural gas use for power generation is estimated to be responsible for an additional 45,000 tonnes of emissions from London in 2022 – 1.6 per cent higher. Whether emissions continue to decrease depends upon the impact of energy and fuel conservation efforts, provincial and federal climate change policies (including incentives), climate trends, economic growth, and consumer choices.

Table 7: Summary of Major Trends and Occurrences in 2022 Influencing Community Greenhouse Gas Emissions

Positive	Unchanged or Unsure	Negative
• Residential energy use per person has seen consistent reductions • Average distance travelled by bike increased • Number of hybrid and electric vehicles in London has increased • Retail sales of fuel per person in 2022 were only 2.5% higher than 2021 and still about 20% below pre-pandemic levels • Installed solar power generation capacity has increased • Industrial, commercial, and institutional energy use per person has seen consistent reductions • Energy productivity ($ GDP per unit energy) increased	• Transportation energy use per person was still noticeably below pre-pandemic levels, but there is uncertainty whether current post-pandemic "hybrid" work arrangements are permanent	• GHG emissions intensity of Ontario's electricity grid has increased • Market share sales of larger personal vehicles (e.g., pickups and SUVs) has increased • Electric vehicle adoption rate in Ontario was lower than Canada's overall rate • Electric vehicle adoption rate in London was lower than Ontario's overall rate

6.2. Scope 1 and 2 GHG Emissions in Context

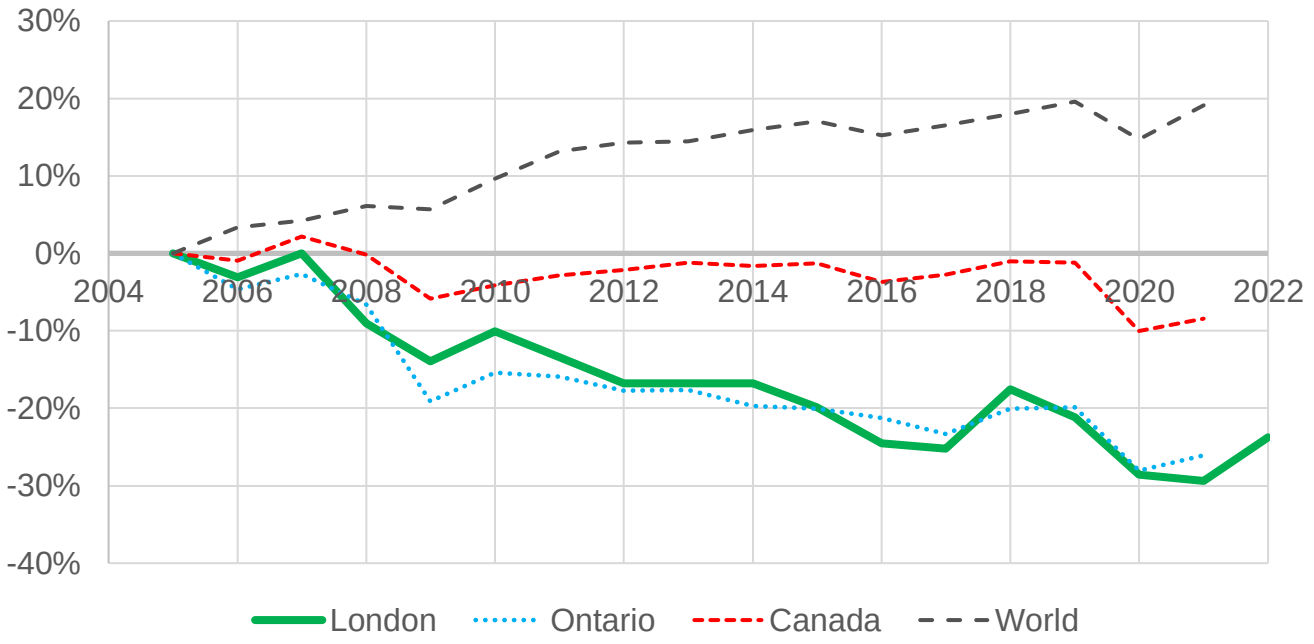
To limit warming to within 2 degrees Celsius, global action is required. The challenges to reducing emissions are not evenly distributed geographically, however, where some countries are well-equipped to take swift action, others are limited by other priorities. In Canada and other wealthy nations, a “fair share”, science-based approach to accelerated climate action is generally believed to be required if international climate targets are to be met. The comparison of the results of international efforts alongside the results of efforts to reduce direct (Scope 1 and 2) emissions in Canada, Ontario and the City of London are presented in Figure 6.

London and Ontario have seen significant reductions to date due to the combination of energy efficiency measures as well as the phase out of coal fired power plants discussed in Section 6.1.2 earlier. Canada’s emissions overall have seen modest reductions, due in large part to increased emissions associated with Alberta’s oil and gas industry offsetting reductions associated with improved energy efficiency. Globally, emissions have been increasing due to increased industrialization and automobile use in China, India, and other countries outside of Europe and North America.

While GHG emissions reduction efforts in Canadian jurisdictions look to be ahead of the global average results, it is very important to understand that the efforts behind these emissions reductions have only just brought London’s per capita emissions roughly in line with global per capita emissions, as presented in Figure 7.

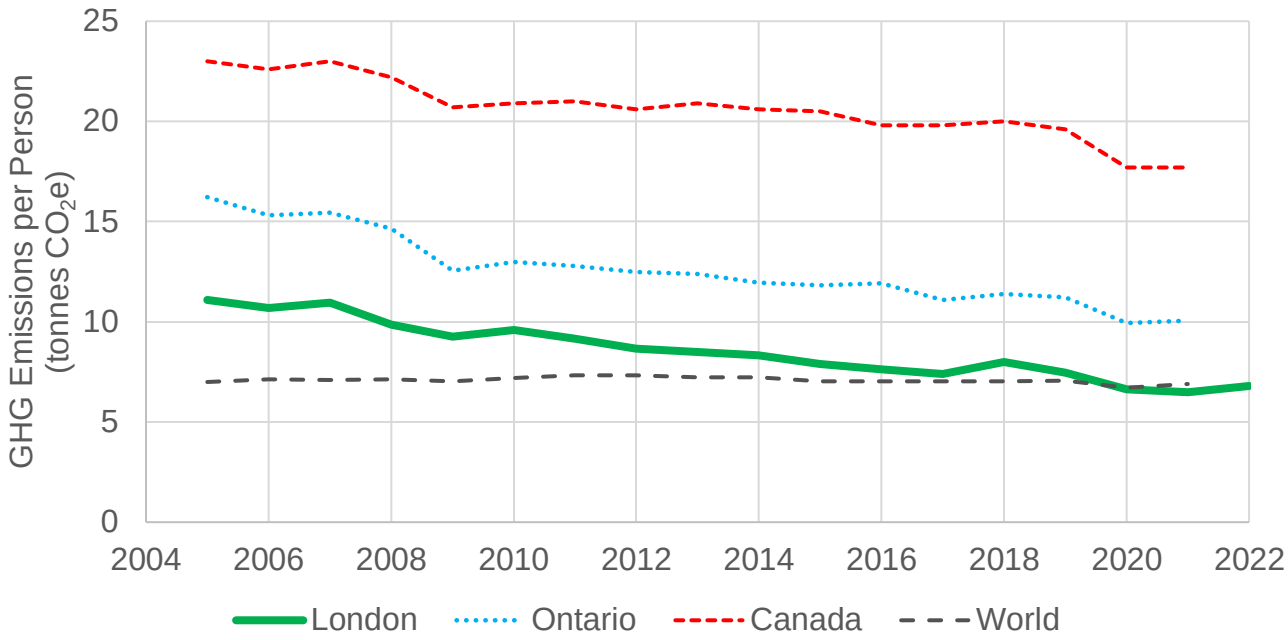
It is also important to note that Londoners use goods and services that are produced in other parts of Ontario, Canada, and the rest of the world. This is discussed further in Section 6.3.

Figure 6 – Change in Scope 1 and 2 Total GHG Emissions from 2005 Baselines



(Source: Data provided by City of London, Environment Canada, Our World in Data)

Figure 7 - Scope 1 and 2 GHG Emissions per Capita



(Source: Data provided by City of London, Environment Canada, Our World in Data)

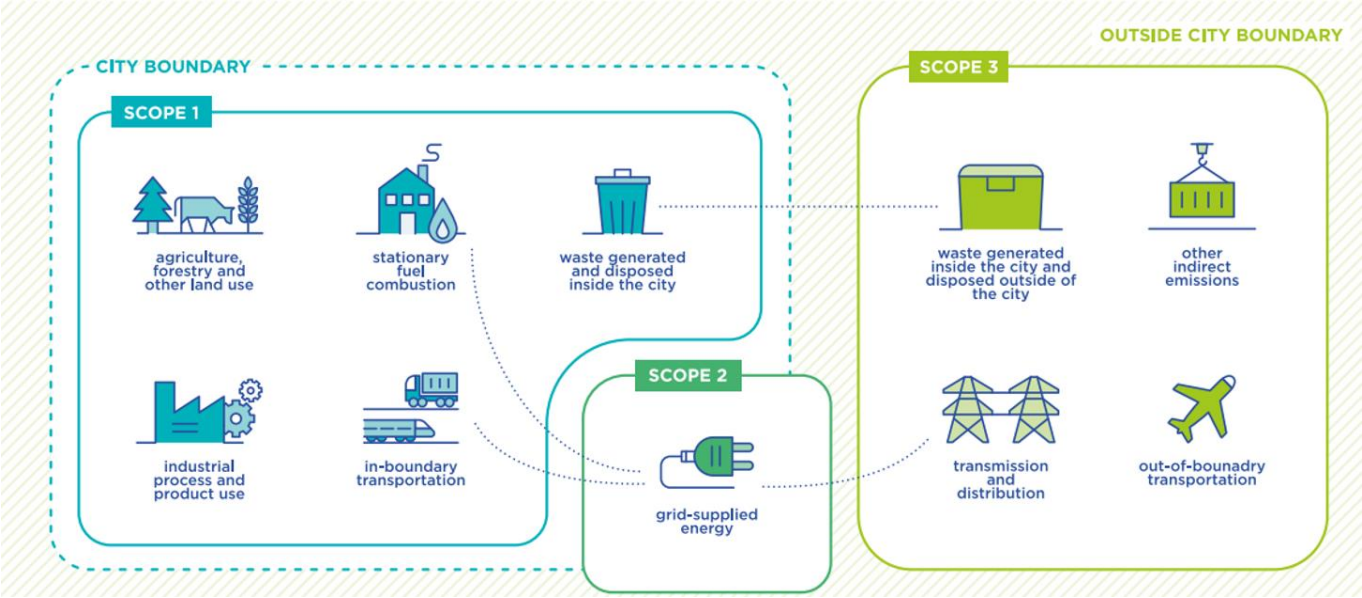
6.3. Consumption-related Emissions (Scope 3)

In 2019, the City of London started highlighting the importance of consumption-related greenhouse gas emissions. These are defined as all the greenhouse gas emissions associated with providing goods and services to Londoners, including those that take place outside London's boundaries. A good example would be the emissions associated with food as the majority comes from outside London. There are emissions associated with growing crops, feeding animals, preparing food products for market, and transporting these to market.

These emissions are also referred to as Scope 3 emissions for London, as illustrated in Figure 8. Local emissions are often referred to as Scope 1 and Scope 2. It is important to note that what may be considered Scope 3 emissions for London would be considered Scope 1 and 2 emissions for someone else. For example, Canada's Scope 1 and Scope 2 emissions per person are a lot higher than London's because they include emissions from Alberta's oil sands, Hamilton's steel mills, and many other sources related to the goods and services Londoners use.

This is becoming an emerging area for municipalities to investigate. City staff have included information on household-level consumption-related emissions in recent Community Energy and Greenhouse Gas Emissions Inventory report going back to the 2019 report. City staff have also been including estimates of Scope 3 emissions associated with food production within food waste reduction program information since 2019. The CEAP included the following action within Area of Focus 10 - Measuring, Monitoring and Providing Feedback of the CEAP the importance of advancing the discussion and awareness of consumption-related emissions.

Figure 8 - Illustration of Scope 1, 2, and 3 emission sources



(Source: Consumption-Based GHG Emissions of C40 Cities)

A consumption-based inventory includes the emissions embedded in the goods and services consumed in the city. This includes the direct emissions of households and personal transportation in the city (i.e., Scope 1 emissions), plus the emissions embedded in the goods and services consumed within the city, regardless of where the goods and services are produced.

The calculation of detailed consumption-based inventories is a complex undertaking. However, Corporate Knights has developed a simplified method for developing a high-level estimate of consumption-based emissions at the city scale. Corporate Knights is a Canadian sustainable-economy media and research corporation. Their publications include the Corporate Knights magazine, published quarterly, with an editorial focus on climate change, responsible investing, and other sustainable economy content that is distributed through The Globe and Mail, The Washington Post, and The Wall Street Journal.

Corporate Knights' research division produces global sustainability rankings, research reports, and financial product ratings based on corporate sustainability performance. This includes their Global 100 Most Sustainable Corporations in the World ranking. This division has also developed a simplified method for developing a high-level estimate of consumption-based emissions at the city scale for use in their Sustainable Cities Index. London was added to their index in 2023, joining nine other Canadian cities – Calgary, Edmonton, Halifax, Montreal, Ottawa, Saskatoon, Toronto, Vancouver, and Winnipeg.

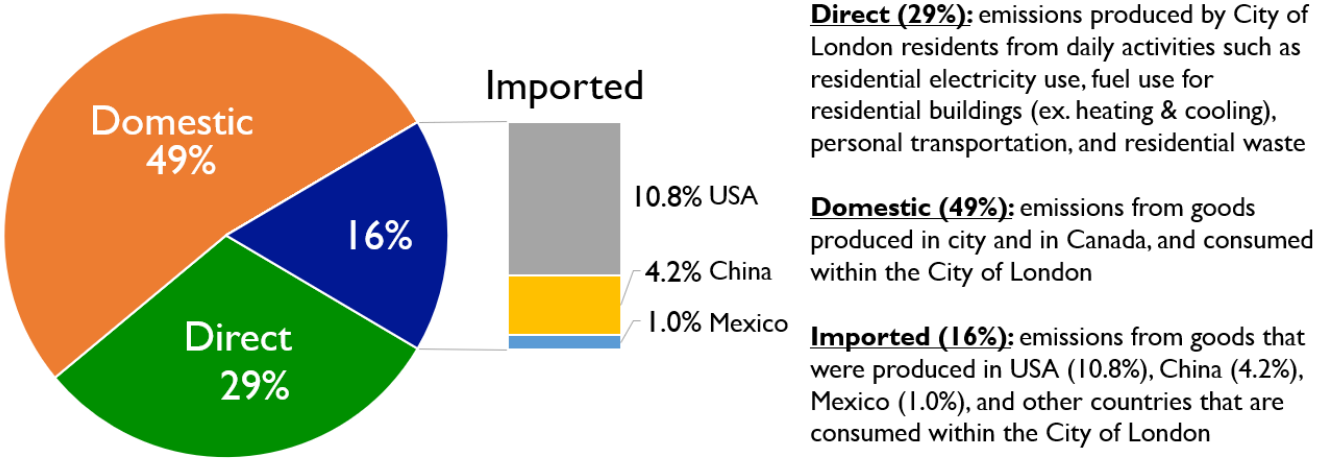
City staff worked with Corporate Knights to apply their methodology to London, Ontario. For more information on how consumption-related emissions were estimated, please refer to the Consumption-based Greenhouse Gas (GHG) Emissions - City of London report in Appendix D. It is important to note that the method(s) used by Corporate Knights has been reviewed independently but not peer reviewed. These details from Corporate Knights represent a good foundation to encourage additional research, more data review and refinement, peer reviews and advance local understanding of the importance of consumption-replated greenhouse gas.

As shown in Figure 9, London's total consumption-based greenhouse gas emissions per person in 2019 were estimated to be over three times higher than a household's direct (Part 1) emissions. About half of the consumption-based emissions are associated with Canadian-made goods and services, including those within London. Imported goods and services accounted for 16 per cent, with the United States and China making up the majority of import-related emissions.

Further work will need to be done to develop a more detailed understanding regarding the relative impact of major types good and services used here in London (e.g., food, consumer goods, construction materials, etc.) to help develop solutions to reduce consumption-related emissions. However, in summary, understanding London's consumption-related emissions helps to support the importance of local environmental initiatives such as:

- Food waste avoidance (reduction);
- Buying durable products;
- Buying local products;
- Recycling and the circular economy (end-of-product-life material recovery and reuse); and
- Repurposing and renovating existing buildings instead of tearing them down.

Figure 9 - Breakdown of London's consumption-related GHG emissions in 2019



(Source: Corporate Knights - Consumption-based Greenhouse Gas (GHG) Emissions - City of London report)

7. Weather Trends and Impacts

What will I learn in Section 7?	You will learn that a changing climate is expected to make London "warmer, wetter and wilder". London has historically experienced severe weather events. This is not something new. The impacts of climate change are being felt in London and area.
Why does Section 7 matter?	London, like other municipalities, is on the front lines of climate change, dealing with extreme weather events such as heat alerts, extreme rainfall, ice storms, and extreme wind events. What has been observed recently are changes in weather patterns and the frequency of events. For example, river flooding is happening more often in all seasons, not just spring. Wind events are occurring more frequently causing damage to trees and neighbourhood properties.
How can I take action?	Depending on your interest, you may wish to: • prepare yourself and others to watch for signs of a changing climate and how you will respond to protect your self and others; • prepare your home or business to handle more severe weather; and/or • make sure you, your household or business are prepared for an emergency;

7.1. Wind Events

On the May long weekend in 2022, a significant regional wind event, termed a 'derecho' occurred, impacting London and continuing westward to create wind damages over a significant portion of Southern Ontario and Quebec. Derechos are described as a widespread, long-lived, straight-line windstorm that may be associated with thunderstorms and tornadoes.

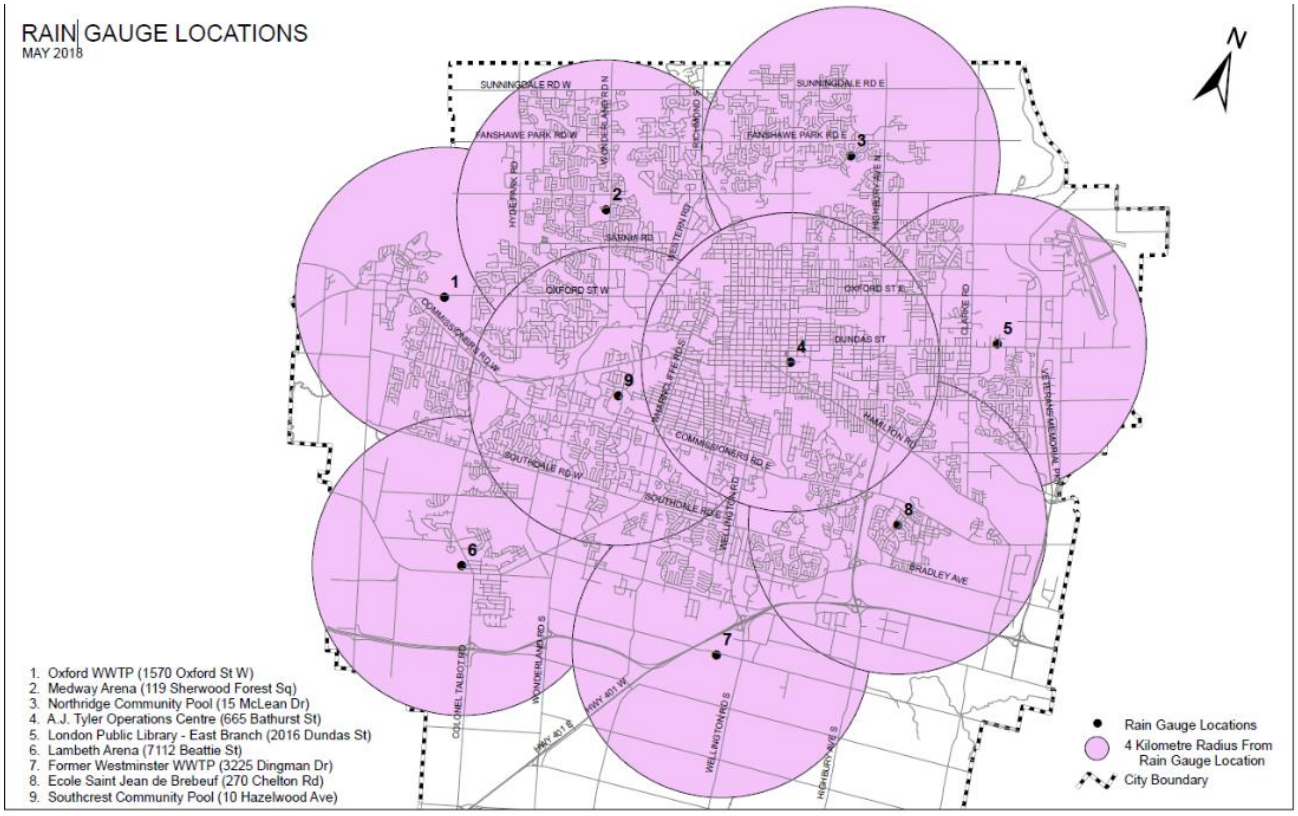
In London, two tornadoes were experienced in the Huron Heights and Wilton Grove neighbourhoods downing trees and uplifting storage buildings with winds up to 175 km/hr. This May 21 derecho is now one of the most deadly and costly thunderstorm events on record in Canada. While over a billion dollars in insured losses was recorded, 12 people lost their lives and at least another 12 were injured mostly from falling trees. The storm's damage path extended over 1,000 km across the most densely populated region in Canada according to the Northern Tornadoes Project (NTP) 2022 annual summary. Since NTP is a London based organization at Western University, wind impact records are planned to be part of the annual CEAP progress reporting.

7.2. Rainfall and Flooding Events

Shorter duration, intense rainfall events are projected to increase in London. In addition to a weather station operated by Environment Canada located at London's International Airport, the City of London has established a series of nine rain gauge stations (Figure 10) to provide neighbourhood-scale coverage for the entire city. A record of precipitation collected from these rain gauges continued in 2022 to show that rainfall amounts can vary considerably across the city (up to 50 per cent difference).

The impacts of these storms are indirectly related to urban (area) flooding and basement flooding calls recorded by City staff. For example, April 2022 rainfall created 84 flooding calls by residents to the city. Using the City's nine gauges, they averaged 70 millimetres of rain for April 2022 which is 20% less rainfall than the monthly long-term average. However, taken individually rainfall amounts at these nine gauges ranged from 61 to 81 millimetres with the airport receiving the least amount (61 mm). Statistics including rainfall duration and intensity illustrating neighbourhood specific, rainfall impacts will be tracked for future CEAP progress reports.

Figure 10 - City of London Rain Gauge Network



(Source: City of London, Environment & Infrastructure, monthly rainfall and flooding memo)

The incidents of river flooding by the Thames River in London has changed over the past decade. Information tracked by the Upper Thames River Conservation Authority indicates that the major floods resulting from spring melt, often referred to as a “spring freshet” event (e.g., rainfall and snowmelt together) are no longer the prominent flood event. The incidents of major floods are much more dispersed across all seasons. For example, winter floods in February 2018 and 2019 reached near historic flood levels comparable to the 1937 Thames River flood. That historic flood caused severe impacts to many London neighbourhoods including The Coves and Blackfriars. Both urban flooding and river flooding data will continue to be tracked in annual CEAP progress reports.

7.3. Average Temperatures

Heating degree-day (HDD) is a measurement tool used to estimate energy demand needed to heat a home or business. A similar measurement, cooling degree-day, reflects the amount of energy used to cool a home or business. It is based on the average outdoor air temperature above which a building needs no heating. For homes, a daily average temperature of 18°C is used as this base.

Environment Canada produces Climate Normal data ranges over a historic 30-year period for the London International Airport. Over the last 10 years, most winters and summers have been warmer than they were over the 1971-2000 period (Figure 11). Using these data, it can be assumed that, over the last 10 years, building heating needs were about seven per cent lower than they would have been back in the 1971-2000 period, and that air conditioning needs were 30 per cent higher.

In 2022, there was an eight per cent increase in heating degree-days compared to 2021. In 2022, natural gas use per person increased by six per cent. However, 2022 was still warmer than the 1971-2000 period.

As warmer temperatures are expected in the future, the impact on the city’s hard surfaces (e.g., pavement, parking lots, roofs) will also increase. Figure 12 shows surface temperatures (red = hotter; green and blue = cooler temperatures) on a typical August day. A closer examination reveals that the cooler surface areas are associated with watercourses and vegetated areas of the city. The inset map illustrates the regional perspective for SW Ontario where warmer temperatures are projected to occur. We are anticipating additional information on London’s ‘heat islands’ in future years as these data sets expand and land use design research advances.

Figure 11 - Recent temperature trends compared to the 1971-2000 period

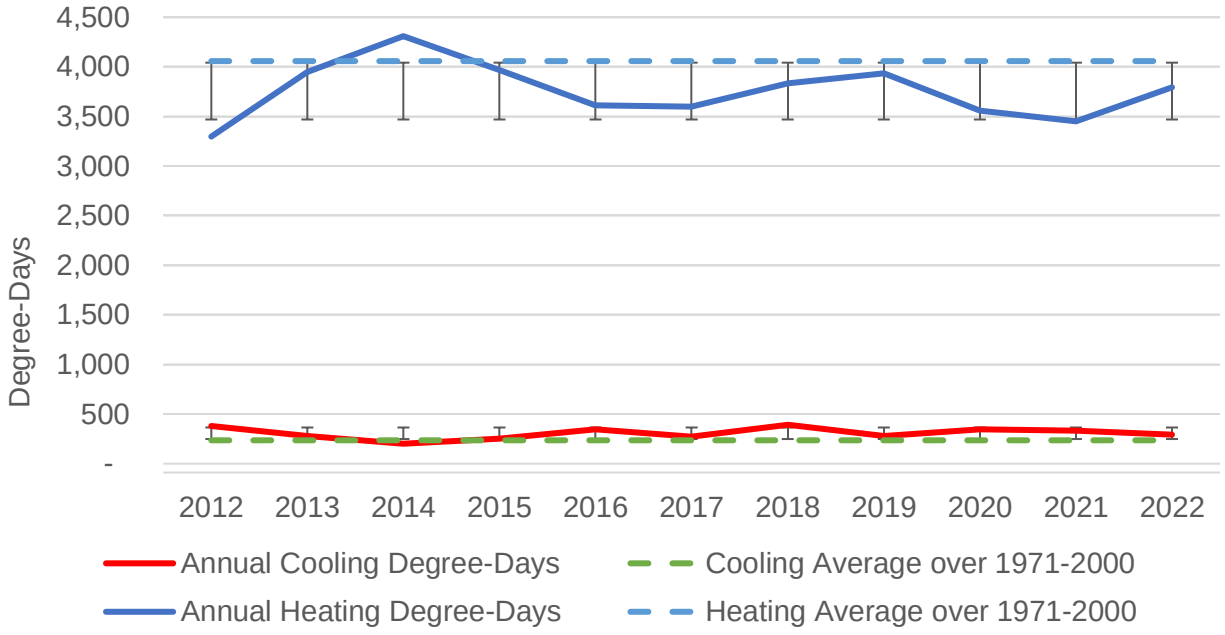
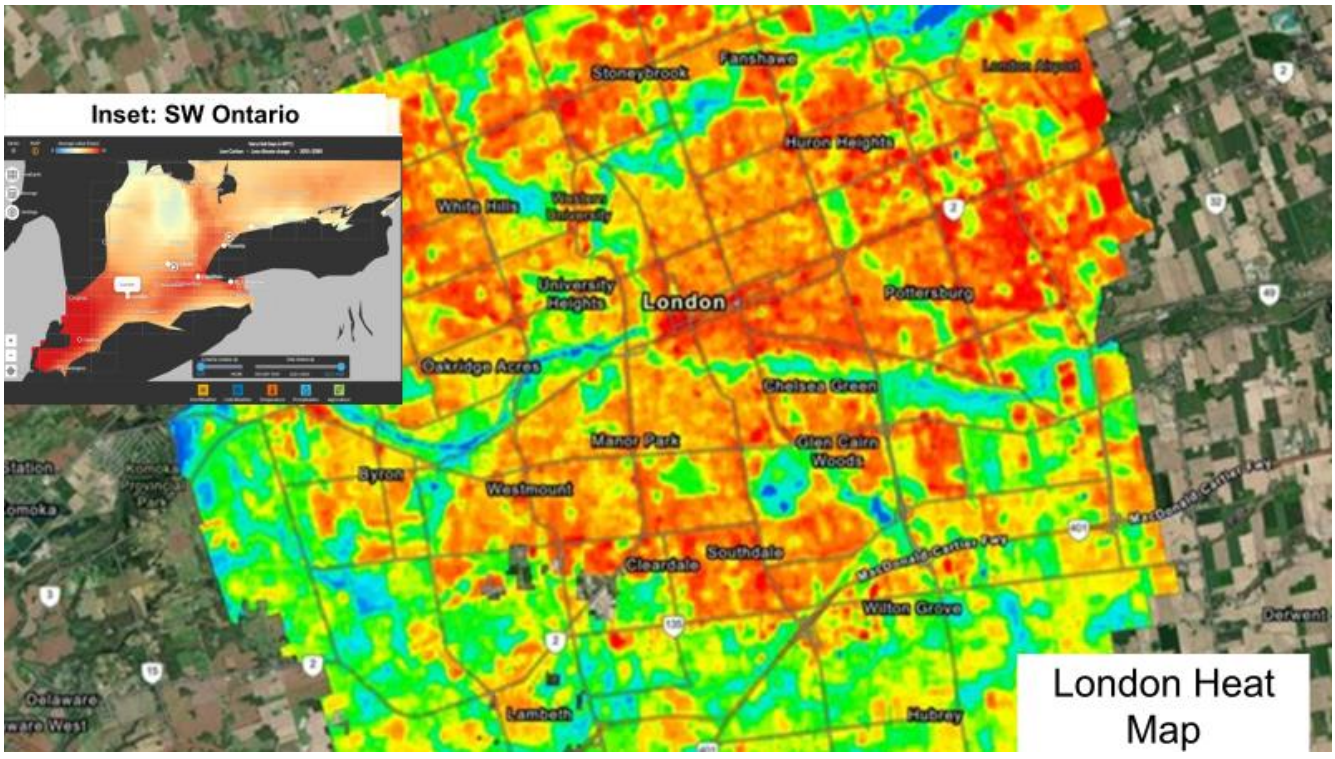


Figure 12 - London Heat Map (illustrating Urban Heat Island Effects)



(Source: Dr. Jamie Voogt, Western University Geography Department Research, 2022)

7.4. Canada Weather Trends and Impacts

West Coast: Major weather events in B.C in 2021 (e.g., wildfires, heat domes and atmospheric river) created transportation disruptions in 2022 to both national road and rail systems impacting London primarily via supply chain challenges. The Port of Vancouver had cargo movement challenges during this time impacting trade and commerce that was felt across the country. The impacts illustrate how connected Central and Eastern Canada are to cross-country weather events impacting commerce. A single London example (noting that this was just a minor inconvenience) is that cups ordered to satisfy the demand for containers to hold "Fats, Oils and Grease (or FOG cups)" were delayed for six months due to Vancouver Port inability to offload goods.

Ontario / Quebec: The May long weekend (May 21, 2022) wind event described as a Derecho (see section 7.1) impacted the most densely populated corridor in Canada travelling from Sarnia to Quebec City. It is now ranked as the 6th most expensive storm for insurance companies in Canadian history with insured losses over a billion dollars. Ontario's Hydro One reported fixing power outages for more than 760,000 customers, replacing 2,500 poles and 500 transformers. Ontario cities such as Kitchener and Peterborough each had over $1 million in damages with the Township of Uxbridge being impacted the greatest.

East Coast: Hurricane Fiona made landfall in October 2022 in Atlantic Canada as a post-tropical storm and is considered the costliest weather event in the Atlantic Region of Canada. When it made landfall at Port aux Basque, N.L. it had winds speeds of more than 130 km/hr and an ocean storm surge that washed 20 homes into the ocean. The frequency and intensity of Atlantic hurricanes is on the increase in recent years (e.g., North America averages 12 per year but 2020 experienced 30). In the past 30 years, hurricanes have increased in number, intensity, and speed of intensification creating more "major hurricanes" being Category 3 and greater (as reported in ScienceNews.org, July 13, 2021, and referenced in "A Force of Nature: Hurricanes in a Changing Climate – NASA, June 1, 2022).

Despite London's inland location, historically the city has been within the track of 14 Atlantic storms that originated with hurricane-strength winds since the early 1900's ("Impacts of Climate Change in London", CEAP Background Report #5, April 2022). Hurricane Hazel in October 1954 is the most 'infamous' Ontario hurricane travelling directly north from the Gulf of Mexico and through Toronto and north to Lake Simcoe. Hazel caused massive flooding, property damage, 7,400 homeless and 81 deaths (Canadian Disaster Database, Public Safety Canada, Government of Canada. Date modified online Sept. 12, 2013).

Large scale, climate changes such as El Nino and La Nina in the Pacific Ocean, will impact the path hurricanes take over an entire season. Therefore, forecasting a specific hurricane is difficult. However, speculation by some hurricane scientists suggest that the impact of warmer air and water temperatures on future hurricanes will mean an increased "staying power" once they reach land making the implications for SW Ontario unknown. Hurricane research by NOAA, NASA and others continues with an increase in "sampling hurricanes by flying into them for more accurate data (Shirley Murillo, deputy director of NOAA's Hurricane Research Division, "A Force of Nature: Hurricanes in a Changing Climate – NASA, June 1, 2022).

7.5. Global Weather Trends and Impacts

The most recent Intergovernmental Panel on Climate Change (IPCC) Synthesis Report from March 2023 has stated the situation most clearly. “More than a century of burning fossil fuels as well as unequal and unsustainable energy and land use has led to global warming of 1.1°C above pre-industrial levels. This has resulted in more frequent and more intense extreme weather events that have caused increasingly dangerous impacts on nature and people in every region of the world”.

The report authors further explain that “every increment of warming results in rapidly escalating hazards. More intense heatwaves, heavier rainfall and other weather extremes further increase risks for human health and ecosystems. In every region, people are dying from extreme heat. Climate-driven food and water insecurity is expected to increase with increased warming. When the risks combine with other adverse events, such as pandemics or conflicts, they become even more difficult to manage.”

“Climate justice” is crucial because those who have contributed least to climate change are being disproportionately affected. Almost half of the world’s population lives in regions that are highly vulnerable to climate change. In the last decade, deaths from floods, droughts and storms were 15 times higher in highly vulnerable regions (IPCC Press Release, March 20, 2023).

From the numerous weather events and trends around the world, one of the most recognizable impacts in London due to global weather in 2022 is the on-going drought affecting agriculture in the southern US states. Produce grown in these areas drastically increased in price due to short supply. This effect has cast a new focus on the demand for locally grown, locally produced food in London and the need to grow urban agriculture.

8. Looking Ahead

8.1. Early Activities in 2023

In addition to the activities detailed in Section 3 of this report, activities have continued in early 2023 with the following additional items of note advancing:

- Council's 2024-2027 Strategic Plan was approved in April 2023. It includes an entire area of focus called Climate Action and Sustainable Growth and another area called Mobility and Transportation.

- Starting in March 2023, development application reports presented to the Planning and Environment Committee contained a climate and environmental impact summary appendix where pertinent information to evaluate a proposed development's alignment with London's climate action commitments were made readily available. This addition is the first step towards applying a climate lens to development proposals.

- Procurement staff have initiated background work required to increase actions, considerations and requirements for the sustainable purchasing section of the Procurement of Goods and Services By-law.

- An order of magnitude costing exercise for CEAP actions has been initiated in preparation for determining business case requirements for the upcoming 2-24-2027 Multi-Year Budget.

- London Fire Department, Finance and Procurement have worked together to release the tendering for the construction of Firehall 15, which includes the requirement that the facility be a net zero emissions building.

- Planning and Economic Development's Long-Range Planning group is engaging consultants to assist with the assessment of London's Environmentally Significant Areas' inclusion in the Corporate Asset Management Plan.

- Green in the City, an awareness and education initiative focusing on the environment and climate change, covered a period from November 2022 to early April 4 by traveling to different libraries and City facilities across London. The initiative was a collaboration between London Public Library, London Environmental Network and the City.

- City staff participated in meetings with staff from neighbouring municipalities, the Ministry of Transportation of Ontario and local Conservation Authority representatives regarding a potential joint submission to the federal $2 billion Tree Program to enable more regional, coordinated tree planting.

8.2. Upcoming Activities in 2023

Many activities either underway and finishing or starting later in 2023 will build upon the initial CEAP implementation momentum realized in 2022. A sample of those items coming within the next few months include:

- Completion of Council's 2024-2027 Strategic Plan will occur in spring 2023 which currently devotes an entire area of focus called Climate Action and Sustainable Growth and Mobility and Transportation

- Development of a longer-term climate change implementation and investment plan that highlights implementation and investments needs beyond a four-year budget cycle.

- Consultation and engagement to inform and direct the City's climate change adaptation plan will commence in Q2 2023 with the release of a Discussion Primer, building upon previous efforts from City staff, community members and non-government agencies.

- Working with Sustainability Solution Group (SSG) to implement a tailored emissions reduction and financial model of London to identify the financial impacts of potential community low-carbon pathways, including an implementation plan that will inform the next iteration of the CEAP.

- Working with the Clean Air Partnership to submit a FCM Community Efficiency Financing Grant and Loan Preliminary Application for the development of a Residential Energy Efficiency Retrofit Pilot Program in London.

- Working with the Canadian Home Builders' Association and the London Home Builders' Association to provide training to local renovators for the Towards Cost-Effective Net-Zero Energy Ready Residential Renovations project.

- Finalization of the biosolids management master plan to guide Wastewater planning for the next 10 to 20 years and capitalize on potential synergies to reduce energy use, reduce greenhouse gas emissions and co-manage landfill gas and source-separated organics management.

- Hosting an event in the fall of 2023 to expand the audience for engagement on CEAP and support the sharing of knowledge on green building and development issues.

- Near the end of 2023 it is expected that supply chain delays will have been overcome and the Green Bin program for residential source-separated organics collection and management will be launched in late fall/early winter.

- Finalization and launch of a Transportation Management Association to support the mobility needs of Londoners and London's employers.

- Development of a bicycle parking plan to guide the build-out of both short-term and secure, longer-term bicycle parking infrastructure as input into the Mobility Master Plan.

- Updating the Urban Forest Strategy and the associated Tree Planting Strategy is underway, with expectations for it to be presented to Council later in 2023. Many challenges to achieving the pace of tree planting required to meet the 2065 tree canopy goal of 34% within the built area boundary will be addressed. Significant City efforts have been put forth recently to maximize plantings on City-owned lands, so a significant focus of the forthcoming strategy update is expected to be on enabling, encouraging and supporting tree planting on private property.

- Urban Forestry is presently seeking an opportunity to partner with the local London and St Association of Realtors (LSTAR) in 2023 to help advance public engagement in our tree canopy cover goals, to achieve successful targeted messaging for new and existing homeowners and landlords.

- Strengthening the protection provided by the Broughdale Dyke, which protects 190 properties north of downtown from Thames River flooding, is expected to start in late 2023 with the support of Federal funding from the Disaster Mitigation and Adaptation Fund (DMAF).

- Creation and installation of signage to both educate and bring attention to climate action projects in the community will be undertaken (e.g., West London Dyke informational sign, Urban Roots urban farm, etc.).

- Reviewing parking policy for employees to explore alternative strategies to encourage alternative modes of transportation into the office.

APPENDIX A - Indicators of Progress

Area of Focus	Indicator	2019	2020	2021	2022
1 - Engaging, Inspiring and Learning from People	Number of CEAP related document downloads	Not Applicable	Not Applicable	Not Applicable	4,270
1 - Engaging, Inspiring and Learning from People	Number of organizations engaged	Not Applicable	Not Applicable	Not Applicable	124
1 - Engaging, Inspiring and Learning from People	Number of participants in City-led or co-led events (estimated)	Not Applicable	Not Applicable	Not Applicable	15,000
1 - Engaging, Inspiring and Learning from People	Number of requests to City Staff for invitations to speak about CEAP	Not Applicable	Not Applicable	Not Applicable	15
1 - Engaging, Inspiring and Learning from People	Number of new groups reached	Not Applicable	Not Applicable	Not Applicable	64
2 - Taking Action Now (Household Actions)	Average natural gas use per residential customer (m3/year)	2,259	2,062	1,936	2,099
2 - Taking Action Now (Household Actions)	Number of participants in community gardens (plus waitlist)	Data not compiled	Data not compiled	Data not compiled	565

Area of Focus	Indicator	2019	2020	2021	2022
3 - Transforming Buildings and Development	Total GHG emissions per year from Industrial, Commercial & Institutional (IC&I) sources (tonnes CO2e)	920,000	930,000	920,000	1,020,000
3 - Transforming Buildings and Development	Total GHG emissions per year from Broader Public Sector Buildings (tonnes CO2e)	157,000	144,000	To be determined	To be determined
3 - Transforming Buildings and Development	Per capita GHG emissions per year from IC&I (tonnes CO2e)	2.24	2.23	2.18	2.35
3 - Transforming Buildings and Development	% of new developments incorporating secure bike parking and storage	Data not compiled	Data not compiled	Data not compiled	19.4%
3 - Transforming Buildings and Development	% of new units built within the built area boundary	Data not compiled	Data not compiled	Data not compiled	56.1%
3 - Transforming Buildings and Development	Average GHG emissions per person from all single-family residential buildings	1.41	1.33	1.22	1.32
3 - Transforming Buildings and Development	Number of EV charging stations available city-wide	48	53	71	84
3 - Transforming Buildings and Development	# of permits issued for residential rooftop solar installations on existing buildings	9	17	11	12

Area of Focus	Indicator	2019	2020	2021	2022
3 - Transforming Buildings and Development	Total installed renewable electricity generation capacity (MW)	20.5	21.4	23.3	24.8
4 - Transforming Transportation and Mobility	% of all light-duty vehicles registered that are ZEV	0.28%	0.37%	0.50%	0.77%
4 - Transforming Transportation and Mobility	% of in-town trips in London taken by active transportation and transit	26.80%	22.20%	20.40%	To be determined
4 - Transforming Transportation and Mobility	% of new model year light-duty vehicles registered that are ZEV	0.4%	0.8%	1.7%	3.2%
4 - Transforming Transportation and Mobility	Number of registered vehicles per person	0.711	0.655	0.674	0.617
4 - Transforming Transportation and Mobility	Total GHG emissions per year from transportation (tonnes CO2e)	1,380,000	1,140,000	1,180,000	1,220,000
4 - Transforming Transportation and Mobility	Per capita GHG emissions per year from transportation (tonnes CO2e)	3.37	2.73	2.79	2.81
4 - Transforming Transportation and Mobility	Retail sales of fuel (litres) per person per year	1,076	835	837	858
4 - Transforming Transportation and Mobility	Retail sales of fuel (litres) per registered vehicle per year	1,590	1,250	1,240	1,390
4 - Transforming Transportation and Mobility	# of m's of new sidewalks provided annually	Data not compiled	4,240	3,100	6,600

Area of Focus	Indicator	2019	2020	2021	2022
4 - Transforming Transportation and Mobility	% of Urban Growth Area streets without sidewalks	Data not compiled	29.8%	29%	28.4%
4 - Transforming Transportation and Mobility	% of vehicle-for-hire fleet that are ZEV	Data not available	0.4%	0.9%	5.3%
4 - Transforming Transportation and Mobility	Public area serviced by low-impact development (LID) drainage installations (Ha)	1.79	3.16	4.82	To be determined
4 - Transforming Transportation and Mobility	Number of EV charge ports per thousand people for public use	0.45	0.50	0.65	0.77
4 - Transforming Transportation and Mobility	Percentage of households within 400 metres of a regular service public transit stop	Data not compiled	Data not compiled	Data not compiled	86%
4 - Transforming Transportation and Mobility	Percentage of households within 400 metres of an express bus transit stop	Data not compiled	Data not compiled	Data not compiled	21%
4 - Transforming Transportation and Mobility	Number of transit rides per capita	60	31	20	To be determined
4 - Transforming Transportation and Mobility	Number of transit rides	24,600,000	12,700,000	8,300,000	To be determined
4 - Transforming Transportation and Mobility	Walking trips per capita	24.6	12.7	8.3	To be determined
4 - Transforming Transportation and Mobility	Vehicle trips per capita	679	544	593	To be determined
4 - Transforming Transportation and Mobility	On-street cycling counts	78,922	79,110	73,188	To be determined

Area of Focus	Indicator	2019	2020	2021	2022
5 - Transforming Consumption and Waste as Part of the Circular Economy	Number of reuse, recycle, compost, digest, recover facilities in London and region	Data not compiled	Data not compiled	Data not compiled	9
5 - Transforming Consumption and Waste as Part of the Circular Economy	Participation rate (household) in Recycling Program	90%	89%	90%	90%
5 - Transforming Consumption and Waste as Part of the Circular Economy	% of residential materials diverted from landfill	45%	44%	45%	44%
5 - Transforming Consumption and Waste as Part of the Circular Economy	Average amount of curbside waste disposed per households (kg/year)	389	397	391	To be determined
6 - Implementing Natural and Engineered Climate Solutions and Carbon Capture	% tree cover outside the urban growth boundary	15.29%	no new info	no new info	no new info
6 - Implementing Natural and Engineered Climate Solutions and Carbon Capture	% tree cover within the urban growth boundary	26.56%	no new info	no new info	no new info
6 - Implementing Natural and Engineered Climate Solutions and Carbon Capture	Number of trees estimated to be planted per year on private property	50,000 city-wide (30,000 inside 2008 UGB)	50,000 city-wide (30,000 inside 2008 UGB)	50,000 city-wide (30,000 inside 2008 UGB)	50,000 city-wide (30,000 inside 2008 UGB)

Area of Focus	Indicator	2019	2020	2021	2022
6 - Implementing Natural and Engineered Climate Solutions and Carbon Capture	Number of trees planted per year on public property	8,384 (6,175 on streets, the rest in Parks)	7,225 (4,004 on streets, rest in Parks)	8,500 (5,294 on streets, rest in Parks)	8,874 (4,250 on streets, rest in Parks)
7 - Demonstrating Leadership in Municipal Processes and Collaborations	% of light duty fleet vehicles zero emission	Data not compiled	Data not compiled	Data not compiled	2.8%
7 - Demonstrating Leadership in Municipal Processes and Collaborations	% of medium duty (off road) fleet vehicles zero emission	Data not compiled	Data not compiled	Data not compiled	10.9%
7 - Demonstrating Leadership in Municipal Processes and Collaborations	Total corporate energy-related GHG emissions per year (tonnes CO2e)	18,500	17,300	16,600	18,900
7 - Demonstrating Leadership in Municipal Processes and Collaborations	Per capita corporate energy-related GHG emissions per year (kg CO2e)	45.1	41.5	40.5	43.9
7 - Demonstrating Leadership in Municipal Processes and Collaborations	Total GHG emissions per year from municipal buildings	8,000	7,470	6,310	7,770
7 - Demonstrating Leadership in Municipal Processes and Collaborations	Total GHG emissions per year from fleet vehicles	7,020	6,910	7,350	7,280
7 - Demonstrating Leadership in Municipal Processes and Collaborations	Total GHG emissions per year from civic infrastructure (water, wastewater, streetlighting)	3,490	2,900	2.960	3,880

Area of Focus	Indicator	2019	2020	2021	2022
7 - Demonstrating Leadership in Municipal Processes and Collaborations	Total GHG emissions from W12A landfill	125,000	94,000	73,000	84,000
7 - Demonstrating Leadership in Municipal Processes and Collaborations	Total GHG emissions from closed municipal landfills	34,000	33,000	32,000	31,000
8 - Adapting and Making London More Resilient	# of adaptation projects to protect critical City facilities and neighbourhoods from flooding	Data not compiled	Data not compiled	Data not compiled	2
8 - Adapting and Making London More Resilient	% of wastewater treatment plants with resilience measures	Data not compiled	Data not compiled	Data not compiled	60%
8 - Adapting and Making London More Resilient	Number of metres of combined sewer remaining	15,900	15,600	14,200	13,300
9- Advancing Knowledge, Research and Innovation	# City climate change projects ongoing in collaboration with educational institutions	Data not compiled	Data not compiled	Data not compiled	13
9- Advancing Knowledge, Research and Innovation	# signed Memorandums of Understanding (MoUs)	Not Applicable	Not Applicable	Not Applicable	1
10 - Measuring, Monitoring and Providing Feedback	Percentage of London Top Employers (over 200 employees) reporting sustainability indicators and/or climate action commitments	Data not compiled	Data not compiled	64%	68%

Area of Focus	Indicator	2019	2020	2021	2022
10 - Measuring, Monitoring and Providing Feedback	Total community GHG emissions per year (megatonnes CO2e)	3.06	2.77	2.74	2.96
10 - Measuring, Monitoring and Providing Feedback	Per capita community GHG emissions per year (tonnes CO2e)	7.5	6.6	6.5	6.8
10 - Measuring, Monitoring and Providing Feedback	Total community energy use per year (terajoules)	60,000	55,600	55,600	58,800
10 - Measuring, Monitoring and Providing Feedback	Per capita energy use per year (gigajoules)	146	133	132	135
10 - Measuring, Monitoring and Providing Feedback	Total community energy costs per year ($ billions)	$1.51	$1.35	$1.49	$1.85
10 - Measuring, Monitoring and Providing Feedback	energy productivity ($GDP per gigajoule)	$786	$772	$838	$830

2022 Corporate Energy Use and Greenhouse Gas Emissions Report

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CANADA

Land Acknowledgement

We acknowledge that we are gathered today on the traditional lands of the Anishinaabek (AUh-nish-in-ah-bek), Haudenosaunee (Ho-den-no-show-nee), Lūnaapéewak (Len-ah-pay-wuk) and Attawandaron (Add-a-won-da-run).

We acknowledge all the treaties that are specific to this area: the Two Row Wampum Belt Treaty of the Haudenosaunee Confederacy/Silver Covenant Chain; the Beaver Hunting Grounds of the Haudenosaunee NANFAN Treaty of 1701; the McKee Treaty of 1790, the London Township Treaty of 1796, the Huron Tract Treaty of 1827, with the Anishinaabeg, and the Dish with One Spoon Covenant Wampum of the Anishnaabek and Haudenosaunee.

This land continues to be home to diverse Indigenous peoples (First Nations, Métis and Inuit) whom we recognize as contemporary stewards of the land and vital contributors to society. We hold all that is in the natural world in our highest esteem and give honor to the wonderment of all things within Creation. We bring our minds together as one to share good words, thoughts, feelings and sincerely send them out to each other and to all parts of creation. We are grateful for the natural gifts in our world, and we encourage everyone to be faithful to the natural laws of Creation.

The three Indigenous Nations that are neighbours to London are the Chippewas of the Thames First Nation; Oneida Nation of the Thames; and the Munsee-Delaware Nation who all continue to live as sovereign Nations with individual and unique languages, cultures and customs.

This Land Acknowledgement is a first step towards reconciliation. It is the work of all citizens to steps towards decolonizing practices and bringing our awareness into action. We encourage everyone to be informed about the traditional lands, Treaties, history, and cultures of the Indigenous people local to their region.

Table of Contents

1. Background

Ontario Regulation 507/18 requires all public agencies to prepare and publish:

- Annually updated reports on the energy consumption and greenhouse gas emissions for City's facilities.

- A Conservation and Demand Management (CDM) Plan, starting in 2014 and updated every five years, to outline strategies for identification and implementation of CDM projects throughout City facilities. The first plan was released in July 2014, and an updated 2019-2023 CDM Plan was released in August 2019.

Ontario Regulation 507/18 reporting requirement does not include significant corporate energy users such as street lighting and corporate fleet fuel use, nor other needs such as sports field lighting. However, these energy needs are included within the scope of this Corporate Energy Consumption and Activities Report as it is imperative that all energy uses and impacts within the City's control are continuously examined for reduction opportunities.

2. Alignment with Existing Plans

This report and the CDM Plan align with:

1. The City's Climate Emergency Declaration: On April 23, 2019, the following was approved by the municipal Council with respect to Climate change:

   Therefore, a climate emergency be declared by the City of London for the purposes of naming, framing, and deepening our commitment to protecting our economy, our eco systems, and our community from climate change.

2. Climate Emergency Action Plan (CEAP): The development of the CEAP is a fundamental response to the City's climate emergency declaration. The CEAP established new targets to reduce the Corporation's energy-related greenhouse gas emissions by 65 per cent below 2007 levels by 2030 and reach net-zero emissions by 2045.

3. City of London Strategic Plan – Climate Action and Sustainable Growth is one of the Strategic Areas of Focus in the 2023-2027 Strategic Plan with key performance indicators being to conserve energy, use clean energy, and increase actions to respond to climate change and severe weather.

3. Methods and Limitations of Measurement

The City procured the EnergyCap software in 2007 to log monthly utility bills for municipally owned and administered buildings and facilities. This software has the capability to track, monitor and capture data to assist the City with reporting consumption and providing historical data.

Fleet fuel use data is provided from the PetroVend fuel management software system which is used for tracking vehicle fuelling at operation centres.

The annual energy consumption and greenhouse gas emissions for the City does not include energy consumed in leased office space where the utility costs are incorporated in the leasing agreements. However, a rough estimate for leased space is provided in Section 5.3.1.

3.1. Service Categories and Energy Consumption

The City manages diverse operations of buildings, including office spaces, community centres, arenas, and fire halls which use energy for interior and exterior lighting, heating and cooling of buildings, and energy associated with maintaining recreational services like pools and arenas. The City also manages linear assets such as wastewater treatment facilities, water supply and pumping facilities, traffic lights, and City fleet operations. Ninety per cent of the energy consumed by linear assets is electricity associated with running and maintaining the processes.

For this report, all the City's service categories are divided in the following categories to compare their individual contribution to City's total energy consumption:

- Buildings
- Wastewater Treatment Plants
- Water Supply Operations
- Traffic Signals & Streetlights, and
- Fleet Operations

3.2. Sources and Emission Factors for Greenhouse Gases

Greenhouse gas emissions within City operations are contributed by consumption of electricity, natural gas, steam, chilled water, diesel, and gasoline. Among these, fleet

fuel, followed by natural gas and steam have the highest emissions per equivalent kWh of fuel as shown in Table 1.

Table 1 - Commodity Emission Factors - Grams of CO_2 equivalent per equivalent kilowatt-hour (kWh)

Commodity	2022
Electricity	43
Natural Gas	182
Diesel	262
Gasoline (E-10 blend)	237
Steam	143
Chilled Water	98

Table Notes:

- The electricity emission factors are based on the 2022 electricity supply mix for Ontario reported by the Ontario Energy Board, combined with the data from *Canada's National Inventory Report 1990-2021*.
- Steam and chilled water are supplied by London District Energy (LDE) for City's downtown office building locations and its associated emissions have been provided by LDE.

4. Performance to 2019-2023 CDM Plan Goals

The City's 2019-2023 CDM Plan primary goal is to achieve a five per cent reduction on overall annual energy use by 2023. The baseline year is 2018. Tied to this goal are:

- A ten per cent reduction in energy use per capita;
- 900 tonnes of avoided greenhouse gas emissions by 2023; and
- Keeping the total energy cost increases within five per cent from 2018 baseline year.

The secondary long-term goals identified in this plan are:

- Monitor and track the City's water consumption starting in 2018; and
- Investigate possible pathways for achieving net zero emissions by 2050 or sooner.

All the City service categories are separated into five areas as below:

- Buildings;
- Wastewater & treatment operations;
- Water pumping operations;
- Traffic signals & streetlights; and
- Vehicle fleet.

Table 2 summarizes the City's detailed progress towards the 2019-2023 CDM goals to date.

In terms of assessing options for achieving net-zero emissions for the Corporation by 2045 or sooner, City staff have engaged Blackstone Energy Services to review and provide supporting information for the internal net-zero analysis carried out by City staff.

Table 2 – 2019-2023 CDM Plan Target Tracking

Goal	2018 Baseline	2023 Target	Progress as of end of 2022	Notes
Reduction in total energy use from 2018 baseline	-	Down by 5%	Down by 5.3%	Exceeding target so far, due in part to COVID-19 shutdowns
Total Energy use (million ekWh)	174	165	165	Meeting target so far.
Energy Performance (ekWh/person)	436	394	380	Exceeding target so far.
Avoided energy related greenhouse gas emissions (tonnes)	-	900	1,100	Based on difference between 2018 and 2022 energy commodity use, combined with current emission factors for commodity. Exceeding target so far.
Total Energy Costs (millions)	$17.9	$18.8	$19.1	Not meeting target due to: • Higher diesel prices • Higher gasoline prices • Higher natural gas prices
Monitor and track water consumption (thousands m^3)	646	-	606	6.7% reduction from 2018 baseline year so far.

Table 3 – Individual Service Category 2019-2023 CDM Plan Tracking

Service Category	2018 Baseline	2023 Target	Progress as of end of 2022	Notes
Buildings (million ekWh)	67.7	64.1	64.5	Decrease in consumption due in part to COVID-19 shutdowns.
Wastewater Treatment Operations (ekWh/megalitre)	738	671	649	Exceeding target so far
Traffic and Streetlights Operations (million ekWh)	18.4	15.1	17.8	4% decrease as of 2021. Phase 1 and Phase 2 LED conversion of streetlights are resulting in continued energy savings year over year.
Water Distribution Operations (million ekWh)	8.7	7.8	9.6	9% increase in electricity use due to equipment issues, which have been repaired
Fleet Operations (tonnes CO_2e greenhouse gas emissions)	7,340	7,090	7,280	Decrease in emissions related to diesel consumption by almost 10% compared to 2018 by switching 6 solid waste packers to CNG. However, the increase in the number of rental vehicles due to COVID-19 health requirements has increased gasoline usage.

Overall, the City's performance in 2022 is currently exceeding the 2019-2023 CDM goal in terms of energy use. The performance in 2022 was still being influenced by COVID-19 restrictions. Increases in greenhouse gas emissions was primarily due to Ontario's electricity grid becoming dirtier due to a greater reliance on natural gas fuelled power plants. Increases in energy costs were driven by higher global fossil fuel prices resulting from the Russian invasion of Ukraine.

5. Annual Corporate Energy Analysis

In 2022, the City's energy use is categorized by consumption, associated emissions, and costs by commodity. The 2022 energy data are also normalized to London's population to measure improvements in efficiency. This allows the City to demonstrate and relay to Londoners the energy consumed in relationship to service delivery provided by the City. For this report, all the 2022 energy emissions data are compared to the following years:

- 2007 – as this was the first year that City started measuring and monitoring its corporate energy consumption; and
- 2018 – as this is the baseline year for the updated 2019-2023 CDM Plan.

5.1. Total Corporate Energy Consumption

With the use of the EnergyCap software, the City has the ability to breakdown and report annual energy consumption by commodity and by service category.

Table 4 – Total Energy Consumption by Commodity

Energy Consumption (ekWh)	2007	2018	2022	Change from 2007	Change from 2018
electricity	108,328,000	98,448,000	93,676,000	-14%	-5%
natural gas	58,682,000	42,430,000	38,687,00	-34%	-8%
steam	3,499,000	3,269,000	2,708,000	-23%	-17%
chilled water	1,759,000	1,521,000	1,277,000	-27%	-16%
diesel fuel	20,129,000	22,194,000	19,639,000	-2%	-11%
gasoline	6,718,000	6,889,000	7,889,000	18%	14%
CNG fuel	-	-	1,330,000	n/a	n/a
Total	199,115,000	174,751,000	165,206,000	-17%	-5%

Table 4 shows the City's energy consumption by commodity, which amounts to 165 million equivalent kilowatt-hours (kWh) in 2022. Energy consumption has decreased for every energy commodity except gasoline, which has seen a 14 per cent increase since 2018. Overall, total energy use is 17 per cent lower compared to 2007 and five per cent lower compared to 2018. Energy associated with heating and cooling buildings (steam, electricity, chilled water, and natural gas) have shown greatest reduction from 2007. This shows that energy efficiency measures in place since 2007 have played a major role in conservation.

Electricity represents 57 per cent of all the energy used by the City. Out of this, 52 per cent is consumed by electricity-intensive operations such as water supply and wastewater treatment plants, 19 per cent is consumed by streetlights and traffic lights, and the remaining 29 per cent is consumed by building ventilation, lighting, and office equipment.

Natural gas is the second highest commodity, representing 23 per cent of the total energy consumption. Most of the natural gas is used for space heating and hot water heating, but 13 per cent of the total natural gas is used in wastewater treatment facilities every year.

Diesel and gasoline are consumed by a variety of fleet vehicles and equipment which include waste collection trucks, snowplows, off-road construction equipment, and portable hand-held tools used by Parks & Recreation.

Compressed natural gas (CNG) is consumed by six of the waste collection packer trucks in the vehicle fleet. In 2022, the CNG packers consumed about 129,000 diesel-litre equivalents of CNG.

Steam and chilled water account for only one per cent of the total energy consumption each and both are completely used by administration buildings owned by the City in downtown London including City Hall. Steam and chilled water are supplied by Enwave London District Energy.

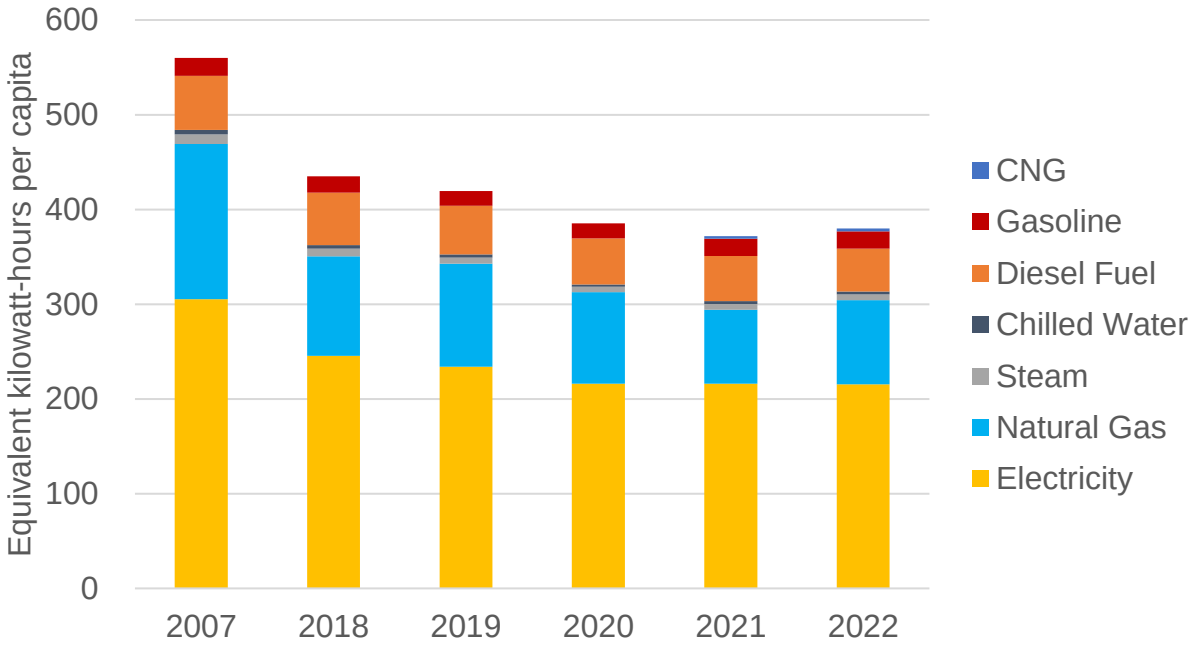
5.2. Total Corporate Energy Consumption Per Capita

The City's energy consumption is a direct function of serving the public, businesses, and visitors of London. The trends in consumption reported is significant to the services provided to the community. London continues to grow in population and increased services are required to support that growth. It is important to capture energy usage per capita to demonstrate the City's achievements in energy reductions while continued growth occurs in London.

Figure 1 shows total energy consumption per capita by commodity which is explained as follows:

- 15 years of data show continued improvement of corporate energy use per capita with an overall reduction of 32 per cent in 2022 compared to 2007; and
- In 2022, overall energy efficiency improved by about 13 per cent compared to 2018. This reduction is due in part to some offices and community service centres still being shutdown in early 2022 due to the COVID-19 pandemic.

Figure 1 - Corporate Total Energy Consumption per Capita by Commodity Type



5.3. Total Corporate Energy Consumption by Service Category

Separating the municipal service by categories gives the City the ability to see where progress is being made and the opportunity to target areas for improvements.

Figure 2 shows buildings as the highest energy consumer at 39 per cent followed by wastewater treatment operations at 27 per cent, fleet operations at 17 per cent, traffic signals & streetlights at eleven per cent, and water operations at six per cent.

Figure 3 shows the overall energy consumption (ekWh) by the municipal service categories over the last five years compared to the 2007 baseline year. The five years are highlighted in this figure to show continuous improvement year over year since 2018.

Most of the energy consumption reductions have been observed in buildings, wastewater treatment operations and traffic signals & streetlights.

Buildings reduced energy consumption by 12 per cent compared to 2007 and four per cent to 2018. Most of the reduction is a result of heating, ventilation, and air conditioning (HVAC) upgrades and LED lighting upgrades.

Figure 2 - City of London 2022 Energy Consumption by Municipal Service Category

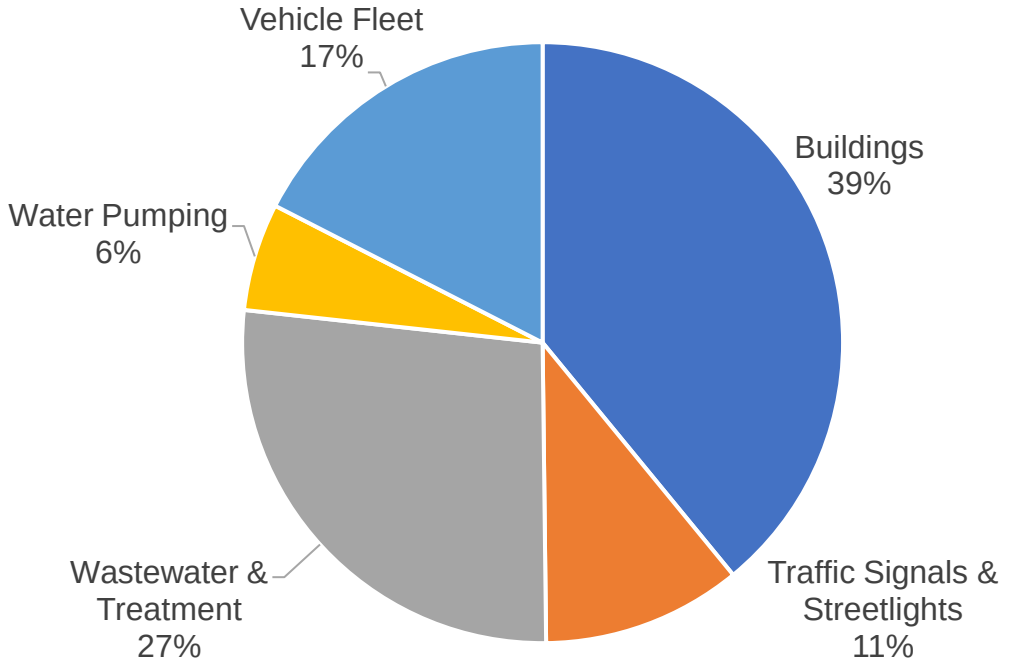
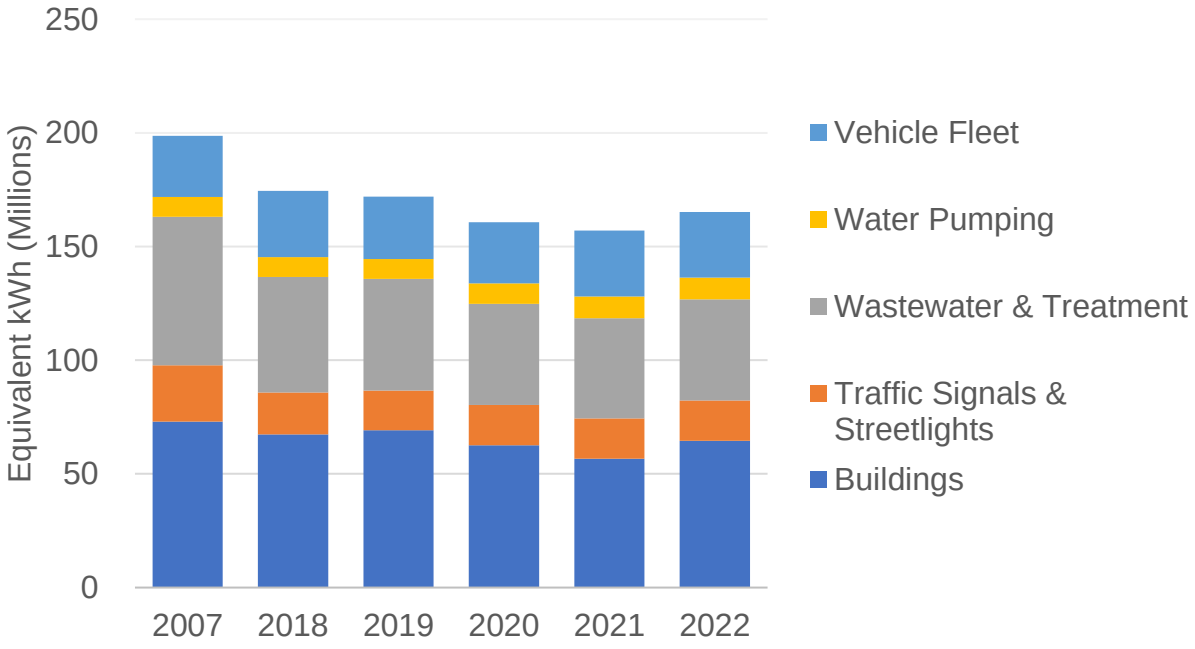


Figure 3 – Total Corporate Energy Consumption by Service Category (ekWhs)



Wastewater treatment continues to see improved energy efficiency as a result of HVAC upgrades, aeration blower upgrades and utilizing waste heat. Energy consumption was reduced by 32 per cent compared to 2007 and 12 per cent compared to 2018.

Energy use by traffic signals and streetlights has decreased by 28 per cent from 2007 and four per cent from 2018.

Fleet fuel consumption has slightly decreased by one per cent since 2018 and is influenced by reduced diesel consumption in 2022 due to six diesel trucks being converted to CNG and due to reduced snow removal compared to previous years. Although total Fleet consumption increased by seven per cent compared to 2007, the per capita consumption shows a decrease of 12 per cent. This shows that the efficiency of fleet operations increased over the years.

Operational issues at the new Southeast Reservoir and Pumping Station (SERPS) water supply facility increased water supply's overall energy consumption by nine per cent compared to 2018.

5.4. Leased Spaces

Leased spaces, for which the City does not pay for utility use, make up 7.3 per cent of city-owned spaces. The energy used by these spaces is not included within the City's reported energy use, but it has been estimated to provide an understanding of its potential contribution overall.

The energy intensity in Canada for office buildings in 2018 was reported to be 0.99 gigajoules per square metre (GJ/m^2) in a report by Natural Resources Canada (NRCan). Assuming the same in 2022, the City's leased spaces are estimated to have consumed about 4,500,000 ekWh which is almost three per cent (2.7%) of the total corporate energy consumption. Considering the leased space would have the same per unit cost and emission factor as the city owned buildings, leased space energy cost would be approximately $430,000 and would result in about 540 tonnes of greenhouse gas emissions in 2022.

5.5. Energy-Related Corporate Greenhouse Gas Emissions

In 2022, greenhouse gas emissions from energy use were one per cent (200 tonnes) higher than 2018, but 58 per cent lower compared to 2007. Figures 4 and 5 show the greenhouse gas emission reduction trend since 2007. Greenhouse gas emission reductions have been observed across the corporation since 2007, except for Fleet. Fleet's greenhouse gas emissions are now a larger share of corporate energy-related emissions due to emissions from burning gasoline, diesel, and compressed natural gas as explained in section 4.2 of this report.

Figure 4 – Corporate Energy-Related Greenhouse Gas Emissions since 2007 by Service Category

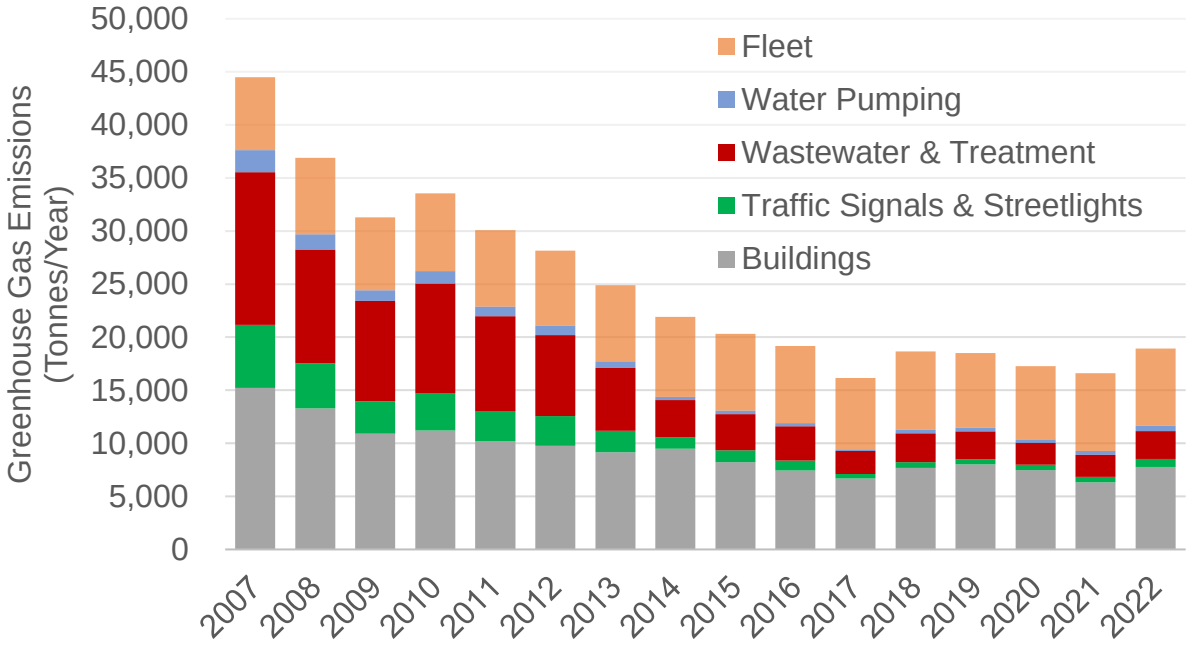
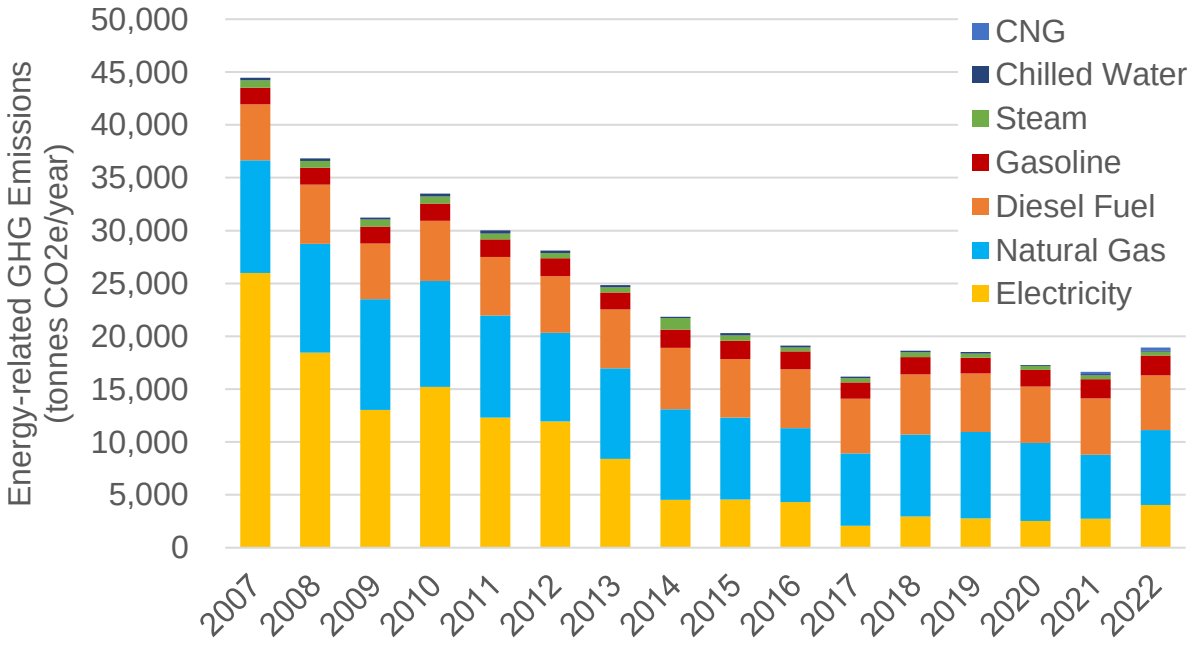


Figure 5 – Corporate Energy-Related Greenhouse Gas Emissions since 2007 by Energy Commodity



Most of the emission reductions since 2007 are due to a cleaner electricity grid in Ontario due to increased conservation efforts and cleaner sources of energy used to generate electricity in Ontario:

- 84% reduction in electricity-related emissions
- 46% reduction in steam-related emissions, due solely to corporate actions; and
- 33% reduction in natural gas related emissions, due solely to corporate actions.

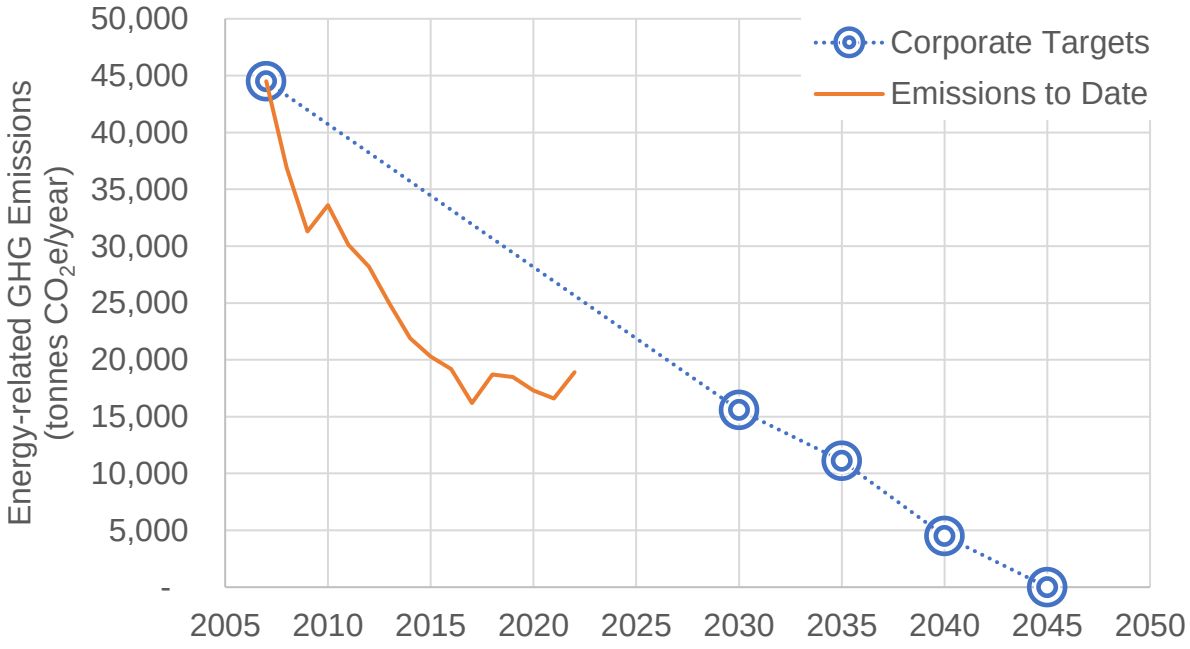
However, in the last couple of years, greenhouse emissions from Ontario's electricity grid have increased, from 29 grams equivalent carbon dioxide per kilowatt-hour in 2019 to 43 grams per kilowatt-hour in 2022. Given that electricity represents 57 per cent of all the energy used by the City, changes in Ontario's electricity grid will have a big impact on corporate energy-related emissions. As a result, the City's greenhouse gas emissions in 2022 are about 1,300 tonnes (seven per cent) higher than they would have been if Ontario's grid emissions had not changed.

Looking ahead, based on power supply forecasts provided by Ontario's Independent Electricity System Operator (IESO), The Atmospheric Fund estimates that greenhouse gas emission factors for Ontario's electricity grid will increase between 2018 and 2035, from 30 to 86 grams of equivalent carbon dioxide per kilowatt hour. This is due to an expected greater reliance on gas-fired power plants after the closure of the Pickering Nuclear Generating Station as well as the Provincial Government's cancellation of the last round of renewable power generation procurement in 2018.

This issue has been raised by over 30 Ontario municipalities, who asked for the Provincial Government to phase-out gas-fired power generation by 2030. The IESO was asked to study this, and they reported back in October 2022 that this timeline was not feasible. However, the Ontario Minister of Energy has asked the IESO to report back on a moratorium on the procurement of new natural gas generating stations and to develop an achievable pathway to zero emissions in the electricity sector in Ontario.

Figure 6 shows corporate energy-related greenhouse gas emissions to date and progress towards meeting the new corporate emission reduction targets established by London's Climate Emergency Action Plan.

Figure 6 – Corporate Energy-Related Greenhouse Gas Emissions to Date Compared to Corporate GHG Emission Reduction Targets



5.6. Non-Energy Related Greenhouse Gas Emissions

The City also has direct control over two major sources of greenhouse gas emissions not associated with energy use:

- Methane emissions from the W12A Landfill as well as closed landfills; and
- Nitrous oxide (N_2O) emissions from the incineration of sewage sludge at the Greenway Wastewater Treatment Facility.

In fact, methane emissions from landfill sites are significantly larger in magnitude than energy related greenhouse gas emissions. With the installation and ongoing expansion of the landfill gas collection and flaring system at the W12A landfill, the City has made significant reductions in greenhouse gas emissions as seen in Table 5.

As a result of London having joined the Compact of Mayors in 2015, nitrous oxide (N_2O) emissions from sewage treatment are now included within London's energy and greenhouse gas emissions inventory as per the Global Protocol for Community-Scale Greenhouse Gas Emission Inventories. Nitrous oxide, a potent greenhouse gas with 310 times the global warming potential of carbon dioxide, is a combustion by-product from the incineration of sewage sludge and its formation is influenced by incinerator operating conditions (i.e., combustion temperature).

Table 5 – Summary of Landfill Gas Flaring at W12A Landfill

Year	Methane Flared (tonnes)	Equivalent CO_2 Reduced (tonnes)	Cumulative Methane Flared (tonnes)	Cumulative CO_2e Reduced (tonnes)
2004	852	21,000	852	21,000
2005	1,980	49,000	2,830	70,000
2006	1,800	45,000	4,630	115,000
2007	1,440	36,000	6,070	151,000
2008	1,850	46,000	7,910	197,000
2009	2,280	57,000	10,200	254,000
2010	2,320	58,000	12,520	312,000
2011	2,660	66,000	15,180	378,000
2012	3,240	81,000	18,420	459,000
2013	4,520	113,000	22,930	572,000
2014	4,170	104,000	27,100	676,000
2015	4,300	107,000	31,400	783,000
2016	5,990	150,000	37,380	933,000
2017	6,380	160,000	43,760	1,092,000
2018	4,290	107,000	48,060	1,200,000
2019	5,250	131,000	53,300	1,331,000
2020	6,790	170,000	60,100	1,501,000
2021	7,860	196,000	67,950	1,697,000
2022	7,670	192,000	75,600	1,774,000

Since 2008, annual stack testing at the Greenway Wastewater Treatment Facility sludge incinerator has included the measurement to nitrous oxide alongside other air pollutants. Table 6 summarizes the nitrous oxide stack test results.

Table 6 - Summary of Stack Test Results for N_2O Emissions from the Greenway Wastewater Treatment Plant's Sewage Sludge Incinerator

Year	Measured average N_2O emissions g/s	Measured average N_2O emissions kg/hour	Estimated annual N_2O emissions tonnes/year	Estimated annual CO2e tonnes/year
2008	0.1	0.4	4	1,200
2009	1.1	3.9	34	10,700
2010	1.1	3.9	34	10,600
2011	1.2	4.4	39	12,000
2012	1.0	3.5	31	9,600
2013	0.2	0.6	5	1,700
2014	1.1	4.1	36	11,000
2015	1.0	3.7	32	10,000
2016	0.3	1.1	9	2,900
2017	2.4	8.6	65	20,200
2018	1.7	6.0	43	13,200
2019	1.5	5.5	33	10,200
2020	0.8	3.0	16	5,100
2021	0.5	1.6	9	2,900
2022	1.2	4.4	26	8,100

As can be seen from the table above, measured emissions of nitrous oxide can vary from year to year.

5.7. Corporate Greenhouse Gas Emissions from Employee Travel

City staff have estimated the greenhouse gas emissions impact associated with employees commuting to work as well as work-related travel in 2017. These types of greenhouse gas emissions indirectly induced by an organization are referred to as "Scope 3" greenhouse gas emissions, with Scope 1 being greenhouse gas emissions directly from corporate activities and Scope 2 being greenhouse gas emissions from the generation of electricity used in corporate activities:

Scope 3: Other indirect emissions, such as the extraction and production of purchased materials and fuels, transport-related activities in vehicles not owned or controlled by the reporting entity, electricity-related activities (e.g., transmission & distribution losses) not covered in Scope 2, outsourced activities, waste disposal, etc.

Greenhouse gas emissions have been estimated for the following:

- Car allowance reimbursements – based on 2017 reimbursement expenditures from Finance, a $0.50/km mileage reimbursement rate, and an assumed 10L/100km average passenger vehicle fuel economy;

- Corporate travel – based on 2017 total travel and convention expenditures from Finance, an assumption of one-third of these costs being air travel costs, published data an average airfare cost per kilometre travelled, and published air travel greenhouse gas emissions per passenger-kilometre travelled; and

- Employee commuting – based on the 2014 City of London Mobility Survey results, average commuting distance based on employee home postal codes, and an assumed 10L/100km average passenger vehicle fuel economy.

Table 7 - Summary of 2017 Employee Travel Greenhouse Gas Emissions

Activity	Cost	Estimated fuel use (L/year)	Estimated greenhouse gas Emissions (tonnes CO_2e/year)
Car allowance	$255,000	51,000	110
Air travel (estimated)	$240,000	not applicable	460
Employee commuting	not applicable	1,200,000	2,500
Total	$495,000		3,500

These provide an order-of-magnitude estimate of the significance of these activities and will be used to help set priorities, particularly for promoting transportation demand management activities (e.g., carpooling, cycling, telecommuting, and transit) for City of London employee commuting.

Given that about 870 City employees were working from home as of March 2020, it is estimated that commuting related greenhouse gas emissions decreased by about 750 tonnes per year in 2022.

5.8. Water Consumption

Water is the second highest utility cost for the City. In 2022 alone, water cost was $2.3 million for the City and hence is an important utility to monitor and track consumption. Figure 6 shows total water consumed by the City plotted along cooling degree-days (CDD - a measure of how hot the summer weather was for that year), given that water use for municipal buildings tends to increase during hot weather when it also tends to be dry. Most of the water consumed at municipal buildings is for public facilities or employee use. Also, the portion of water consumed by buildings and wastewater treatment facilities is identified in the graph.

Figure 7 also shows:

- Buildings consume 80 per cent of the total water consumed by City;
- Buildings water consumption is influenced by weather i.e., with hotter weather, as measured by cooling degree days, water consumption and vice versa; and
- Wastewater operations consume about 20 per cent of the total water consumed by the City. Majority of this usage is in summer months to flush and clean wastewater holding tanks at pumping stations.

Figure 8 shows how water consumption has been reduced by 21 per cent from 2007 to 2022. During the same period, water cost increased by double due to the changes made to water billing between 2012 and 2014.

Figure 7 – Total Water Consumption (cubic metres per year)

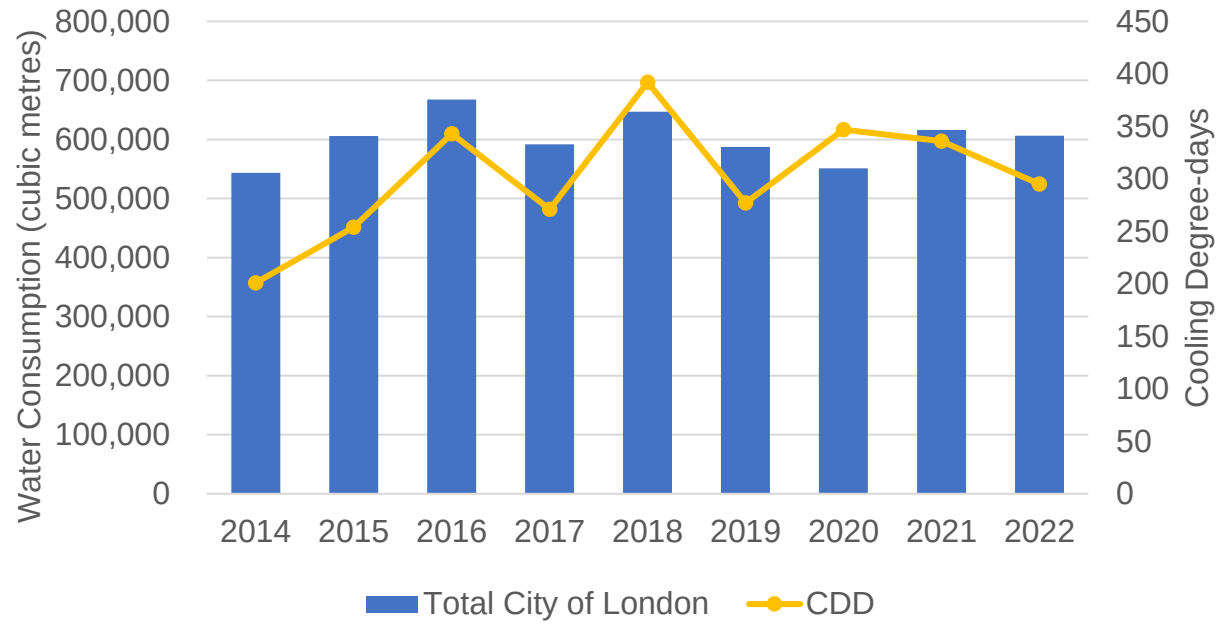
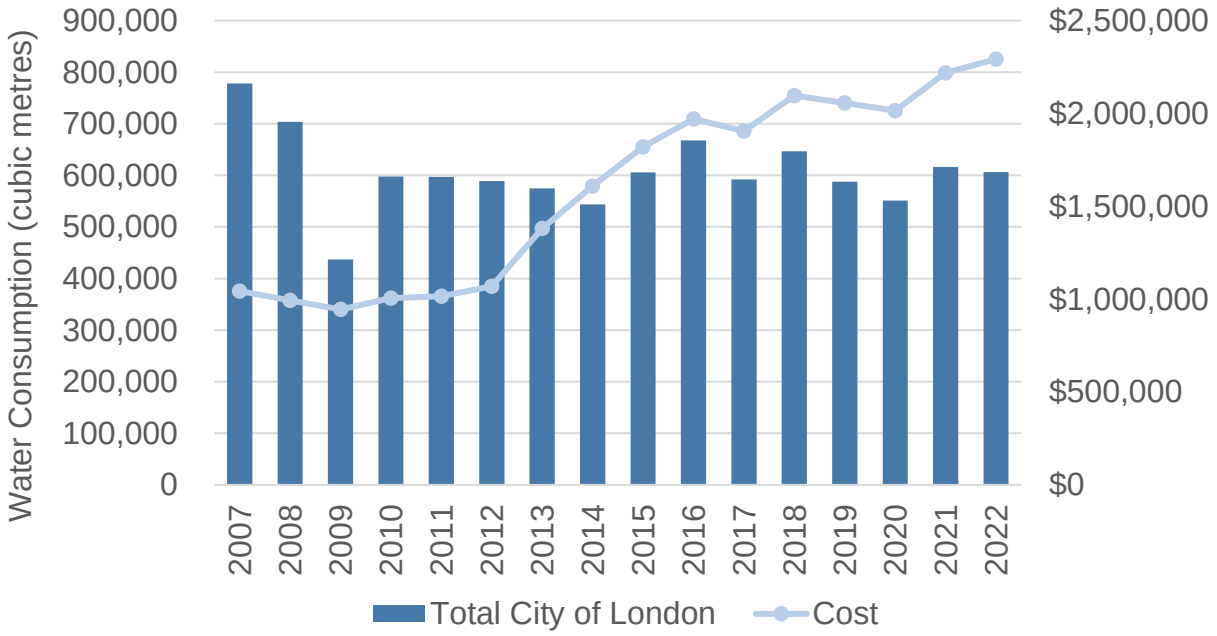


Figure 8 – Water Cost and Consumption (cubic metres per year)



5.9. Corporate Energy Cost

In 2022, corporate energy costs were significantly impacted by the global price increases on fossil fuels because of the Russian invasion of Ukraine. This was offset somewhat by lower electricity prices in Ontario because of the provincial government's decision to subsidize electricity prices in Ontario.

Corporate energy management practices by the City including cost avoidance measures through procurement, building retrofits, and other conservation measures assist in continued efforts to reduce amounts of energy used to help reduce the market cost increase.

Table 8 – Energy Costs by Commodity

Commodity	2007	2018	2022	Change since 2007	Change since 2018
Electricity	$9,289,000	$13,520,000	$12,459,000	34%	-8%
Natural Gas	$2,350,000	$1,029,000	$ 2,014,000	-14%	96%
Steam	$273,000	$192,000	$258,000	-5%	34%
Chilled Water	$251,000	$277,000	$257,000	2%	-7%
Diesel Fuel	$1,518,000	$2,133,000	$2,907,000	92%	36%
Gasoline	$664,000	$755,000	$1,202,000	81%	59%
CNG fuel	-	-	$95,000	-	-
Total	**$14,345,000**	**$17,906,000**	**$19,097,000**	**33%**	**7%**

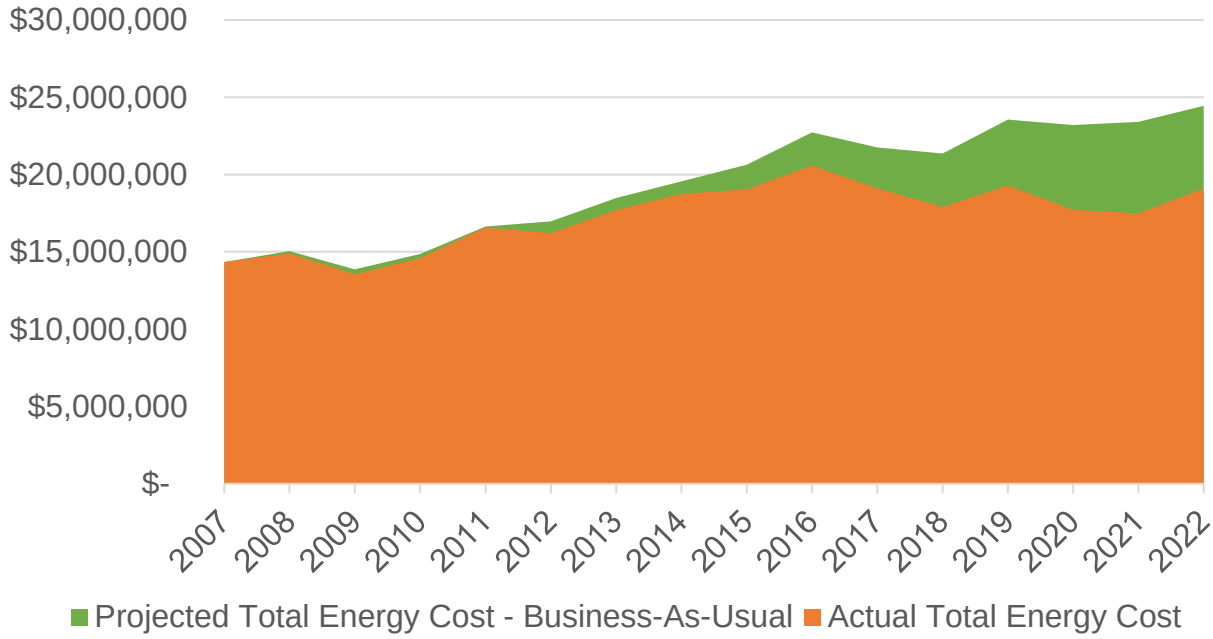
Total energy costs in 2022 were $19.1 million, 33 per cent higher than 2007 and seven per cent higher compared to 2018. As shown in Table 8, electricity price still plays a major role in overall commodity costs.

Over the short term, compared to 2018, electricity prices are lower due to the Arva Pumping Station being classified as a Class A customer by the IESO and other reliefs on electricity rates made by provincial government on hourly rates.

Natural gas and gasoline fuel cost increases are also directly related to carbon pricing. However, the impact of this was dwarfed by the global increase in commodity costs.

Energy efficiency and conservation measures have a cumulative financial benefit for the City of London. Avoided energy costs are estimated by comparing the City's use of energy commodities on a per person basis (an estimate of energy efficiency for service delivery) every year compared to our baseline year (2007). Figure 9 shows that approximately $6 million in energy costs were avoided in 2022 compared to 2007 levels and more than $28 million in avoided energy costs have been accumulated since 2007. This chart also shows that energy efficiency and conservation measures have counteracted the impact that higher energy commodity prices could have had on the City of London's Operating Budget.

Figure 9 - Avoided Energy Costs (Accumulated)



The City requires several different initiatives to sustain and/or reduce energy costs. The cost per capita dropped between 2016 and 2022 (from $54 per person to $44 per person in 2022) even with higher fossil fuel costs. The energy improvements and cost avoidance measures being implemented today are trying to avoid and sustain the market changes and inflation costs the City is faced with in the associated costs to procure energy.

6. Conclusion

Overall, 2022 saw a continued shift in focus from making decisions based on the reduction of energy usage to decision-making with a climate change perspective, particularly as it related to projects and funding opportunities for projects. Many internal studies are underway to identify net-zero opportunities at individual facilities. Energy consumption and emissions in recent years have also seen reductions due to some municipal facilities buildings being shutdown due pandemic restrictions.

The City declared a climate emergency to focus its future development, infrastructure, corporate energy planning and community engagement to improve the City's resiliency plans and favorable climate change outcomes.

The City will always require energy to operate its facilities, vehicles, and operations, but strategic management of energy usage, emissions, investment in renewable technologies and a keen focus on climate change can help use less, become carbon neutral and greener overall. Detailed energy consumption and cost numbers are listed in Appendix A.

Appendix A – Energy Consumption and Cost Tables

Total Energy Consumption

Table A-1 – Consumption (equivalent kilowatt-hours) by Commodity 2018-2022

Energy Commodity	2018	2022	Change since 2018	% Change
Electricity	98,448,000	93,676,000	(4,772,000)	-5%
Natural Gas	42,430,000	38,687,000	(3,433,000)	-9%
Steam	3,269,000	2,708,000	(561,000)	-21%
Chilled Water	1,521,000	1,277,000	(244,000)	-19%
Diesel Fuel	22,194,000	19,639,000	(2,555,000)	-13%
Gasoline	6,889,000	7,889,000	1,000,000	13%
CNG	-	1,330,000	1,330,000	100%
Total	***174,751,000***	***165,206,000***	***(9,235,000)***	***-6%***

Table A-2 – Consumption (equivalent kilowatt-hours) by Commodity 2007 – 2022

Energy Commodity	2007	2022	Change since 2007	% Change
Electricity	108,328,000	93,676,000	(14,652,000)	-14%
Natural Gas	58,682,000	38,687,000	(19,567,000)	-34%
Steam	3,499,000	2,708,000	(791,000)	-23%
Chilled Water	1,759,000	1,277,000	(482,000)	-27%
Diesel Fuel	20,129,000	19,639,000	(490,000)	-2%
Gasoline	6,718,000	7,889,000	1,171,000	17%
Total	***199,115,000***	***1,330,000***	***1,330,000***	

Energy Consumption by Municipal Service Categories

Table A-3 Consumption (equivalent kilowatt-hours) by Municipal Service Categories 2018 – 2022

Service Category	2018	2022	Change since 2018	% Change
Buildings	67,659,000	64,533,000	(2,879,000)	-4%
Traffic Signals & Streetlights	18,421,000	17,762,000	(659,000)	-4%
Wastewater & Treatment	50,823,000	44,483,000	(6,283,000)	-12%
Water Pumping	8,764,000	9,570,000	811,000	9%
Vehicle Fleet	29,083,000	28,858,000	(225,000)	-1%
Total	***174,750,000***	***165,206,000***	***(9,235,000)***	***-5%***

Table A - 4 – Consumption (equivalent kilowatt-hours) by Municipal Service Categories 2007 – 2022

Service Category	2007	2022	Change since 2007	% Change
Buildings	73,225,000	64,533,000	(8,435,000)	-12%
Traffic Signals & Streetlights	24,762,000	17,762,000	(7,000,000)	-28%
Wastewater & Treatment	65,594,000	44,483,000	(20,942,000)	-32%
Water Pumping	8,687,000	9,570,000	883,000	10%
Vehicle Fleet	26,847,000	28,858,000	2,011,000	7%
Total	***199,115,000***	***165,206,000***	***(33,483,000)***	***-17%***

Energy Consumption per Capita by Municipal Service Categories

Table A-5 Consumption (equivalent kilowatt-hours) Per Capita 2018 – 2022

Service Category			Change since 2018	Change since 2018
	2018	**2022**	**Variance**	**% Change**
Buildings	169	148	(33.9)	-20%
Traffic Signals & Streetlights	46	41	(4.0)	-9%
Wastewater & Treatment	127	102	(22.1)	-17%
Water Pumping	22	22	0.6	3%
Vehicle Fleet	73	66	(3.8)	-5%
Total	***436***	***380***	***(63.2)***	***-15%***
London's Population	401,000	435,000	34,000	8%

Table A-6 Consumption (equivalent kilowatt-hours) Per Capita 2007-2022

Service Category			Change since 2007	Change since 2007
	2007	**2022**	**Variance**	**% Change**
Buildings	206	148	(57)	-28%
Traffic Signals & Streetlights	70	41	(29)	-41%
Wastewater & Treatment	185	102	(82)	-45%
Water Pumping	24	22	(2)	-10%
Vehicle Fleet	76	66	(9)	-12%
Total	***561***	***380***	***(180)***	***-32%***
London's Population	355,000	435,000	80,000	23%

Energy Costs per Capita by Municipal Service Categories

Table A-7 – Energy Costs Per Capita 2018- 2022

Service Category			Change from 2018	Change from 2018
	2018	**2022**	**Variance**	**% Change**
Buildings	$ 12.90	$14.17	$1.27	10%
Traffic Signals & Streetlights	$ 8.45	$6.96	$(1.48)	-18%
Wastewater & Treatment	$ 13.45	$10.96	$(2.49)	-18%
Water Pumping	$ 2.66	$2.36	$(0.29)	-11%
Fleet	$ 7.20	$9.45	$2.24	31%
Total	***$ 44.66***	***$43.90***	***$(0.76)***	***-2%***
London's Population	401,000	435,000	34,000	8%

Table A-8 – Energy Cost Per Capita 2007- 2022

Service Category			Change since 2007	Change since 2007
	2007	**2022**	**Variance**	**% Change**
Buildings	$ 14.31	$14.17	$(0.14)	-1%
Traffic Signals & Streetlights	$ 5.29	$6.96	$1.67	32%
Wastewater & Treatment	$ 12.59	$10.96	$(1.63)	-13%
Water Pumping	$ 2.07	$2.36	$0.29	14%
Fleet	$ 6.15	$9.45	$3.30	54%
Total	***$ 40.41***	***$43.90***	***$3.49***	***9%***
London's Population	355,000	435,000	80,000	23%

Greenhouse Gas Emissions

Table A-9 – Greenhouse Gas Emissions (tonnes/year) by Commodity

Commodity	2007	2022	Change since 2007	% Change
Electricity	26,000	4,030	(21,970)	-85%
Natural Gas	10,650	7,110	(3,540)	-33%
Diesel Fuel	5,290	5,160	(130)	-2%
Gasoline	1,590	1,870	280	18%
Steam	700	380	(320)	-46%
Chilled Water	240	130	(110)	-46%
CNG		250	250	
Total	***44,500***	***18,900***	***(25,600)***	***-58%***

Table A-10 – Greenhouse Gas Emissions (tonnes/year) by Service Category

Service Category	2007	2022	Change since 2007	% Change
Buildings	15,210	7,820	(7,390)	-49%
Traffic Signals & Streetlights	5,940	790	(5,150)	-87%
Wastewater & Treatment	14,400	2,670	(11,730)	-81%
Water Pumping	2,080	520	(1,560)	-75%
Fleet	6,880	7,280	400	6%
Total	***44,500***	***18,900***	***(25,600)***	***-58%***

2022 Community Energy Use and Greenhouse Gas Emissions Inventory

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Land Acknowledgement

We acknowledge that we are gathered today on the traditional lands of the Anishinaabek (AUh-nish-in-ah-bek), Haudenosaunee (Ho-den-no-show-nee), Lūnaapéewak (Len-ah-pay-wuk) and Attawandaron (Add-a-won-da-run).

We acknowledge all the treaties that are specific to this area: the Two Row Wampum Belt Treaty of the Haudenosaunee Confederacy/Silver Covenant Chain; the Beaver Hunting Grounds of the Haudenosaunee NANFAN Treaty of 1701; the McKee Treaty of 1790, the London Township Treaty of 1796, the Huron Tract Treaty of 1827, with the Anishinaabeg, and the Dish with One Spoon Covenant Wampum of the Anishnaabek and Haudenosaunee.

This land continues to be home to diverse Indigenous peoples (First Nations, Métis and Inuit) whom we recognize as contemporary stewards of the land and vital contributors to society. We hold all that is in the natural world in our highest esteem and give honor to the wonderment of all things within Creation. We bring our minds together as one to share good words, thoughts, feelings and sincerely send them out to each other and to all parts of creation. We are grateful for the natural gifts in our world, and we encourage everyone to be faithful to the natural laws of Creation.

The three Indigenous Nations that are neighbours to London are the Chippewas of the Thames First Nation; Oneida Nation of the Thames; and the Munsee-Delaware Nation who all continue to live as sovereign Nations with individual and unique languages, cultures and customs.

This Land Acknowledgement is a first step towards reconciliation. It is the work of all citizens to steps towards decolonizing practices and bringing our awareness into action. We encourage everyone to be informed about the traditional lands, Treaties, history, and cultures of the Indigenous people local to their region.

Table of Contents

1. Purpose of this Document

The purpose of this document is to provide an overview of:

- energy consumption in London (a high-level inventory of energy use) during the period 1990 to 2022;
- associated greenhouse gas (GHG) emissions; and
- energy expenditures in London.

On April 23, 2019, the following was approved by Municipal Council with respect to climate change:

> *Therefore, a climate emergency be declared by the City of London for the purposes of naming, framing, and deepening our commitment to protecting our economy, our eco systems, and our community from climate change.*

London's Climate Emergency Action Plan (CEAP) was approved by Council in April 2022. Within the CEAP, listed under Area of Focus 10 – *Measuring, Monitoring and Providing Feedback* workplan, actions for the City of London include:

> 1.a. Continue to provide Londoners with the latest information on local greenhouse gas emissions and the expected impacts of climate change.
>
> 3.c. Provide Municipal Council with a report on community wide and corporate GHG emissions on an annual basis.
>
> 3.d. Provide the public with an easy-to-find and easy-to-use platform(s) and visuals for presenting information on Climate Emergency Action Plan implementation progress, community-wide GHG emissions, corporate GHG emissions, and progress on adaptation measures being undertaken.

This document is the measurement tool to highlight London's progress towards meeting its community energy reduction and GHG emissions reduction targets along with other targets and directions.

The City of London also reports this information on an annual basis to Carbon Disclosure Project (CDP) Cities and the Global Covenant of Mayors for Climate & Energy.

A complete listing of previous reports is found in Section 3.

2. Background

The City of London does not have direct control over how much energy is used in London, but it does have influence. The control over energy use in London rests primarily with citizens, visitors, employers, and employees. Individual and collective action with respect to sustainable energy use, energy management, and energy conservation is critical for our future.

There are many factors that influence how much energy a city uses to function and thrive:

Land use and urban development – planning city growth sets the framework for how much energy is needed for a city to function. Mixed density balances the energy-efficiency of higher-density and social demand for living space. Mixed land use reduces the distance people and goods need to travel.

Urban design – urban design can either negate or enhance the energy efficiency benefits of good functional planning (mixed land use and mixed density). This includes design factors such as connectivity between city blocks, streetscape design, and street orientation.

Transportation – transportation planning accounts for the movement of people and goods. In an ideal world, you would minimize the interactions between the two. However, the reality is that a city's transportation network often must serve both needs at the same time. An energy-efficient transportation system is one that provides several competitive choices for the movement of people and goods.

Buildings – The design, construction, and maintenance of all building types (homes, office buildings, commercial, institutional, and industrial buildings) have a significant impact on the energy consumed by buildings. New buildings can be designed that approach net-zero energy use, but most of London's buildings are old, inefficient designs that often have unseen problems with their insulation and draft-proofing. Building type can also affect energy use and associated emissions. Building energy modelling done for the London Energy Efficiency Partnership (LEEP) Project indicates the following:

- Single-family residential buildings (detached, semi-detached and row housing) require more energy for winter space (interior) heating than for summer space (interior) cooling;
- Conversely, commercial office buildings require more energy for summer space cooling than for winter space heating; and
- Multi-unit residential buildings generally have a balance between annual space heating and space cooling energy demand.

Personal choices and actions – Design and technology has its limits. For example, a programmable thermostat has no energy conservation benefit if its user does not program it. Social norms are a powerful influence on people's behaviour.

Local economy – the nature of the economic base will influence how much energy it will use. For some businesses, energy use is a minor cost. For others, energy bills can make the difference between profit and loss. For many local employers, there are opportunities for energy conservation, energy-efficiency, and renewable energy generation waiting to be developed.

Leadership – Spoken words, commitments, and actions drive change and influence both residents and other leaders. Actions taken by leaders in the business, institutional, government and our communities with respect to energy conservation, reducing the use of fossil fuels, reducing GHG emissions, and adapting to climate change will inspire others to act.

Seasonal weather variations can affect energy use and associated emissions. London's climate is one that is dominated by heating demand during cold weather months. On average, the heating season starts in late September and ends in May. With climate change, energy demand for heating is expected to fall.

The energy demand for space cooling (i.e., air conditioning) in London is relatively small compared to space heating. However, on a hot summer day, a typical household's electricity demand will be three times greater than a cool summer day. This short term "peak demand" places strain on Ontario's electricity generation and supply system. With climate change, the energy demand for air conditioning is expected to increase.

3. Previous Inventory Reports

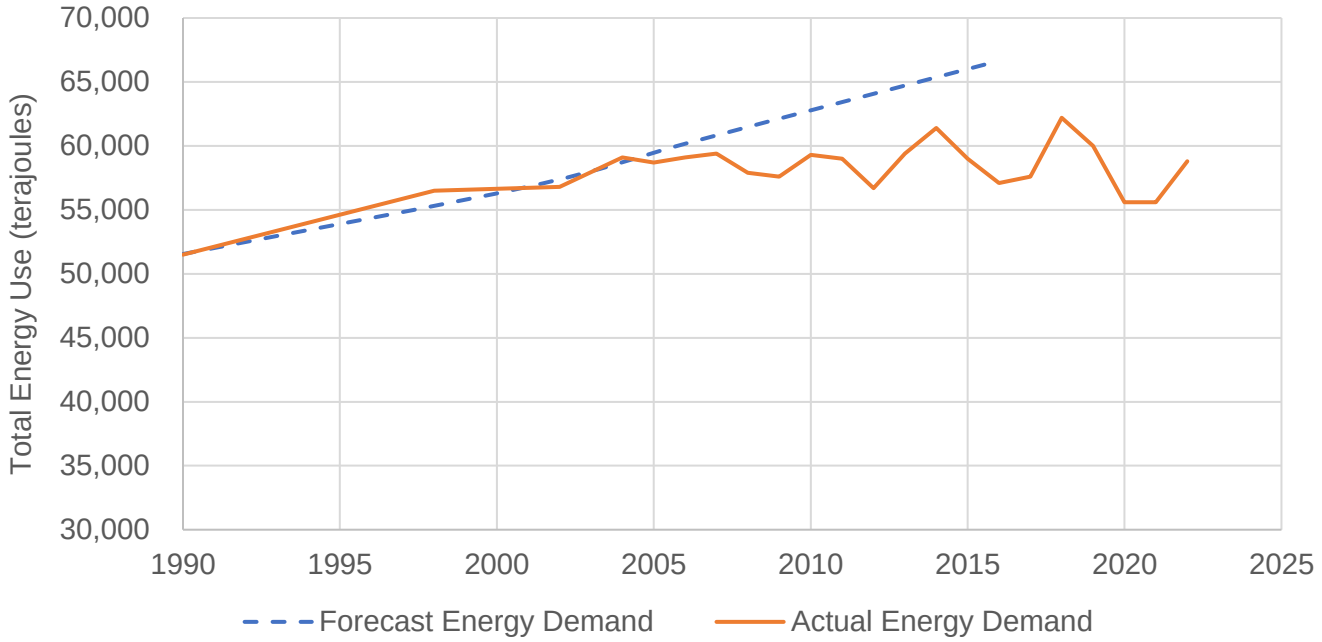
The following is a list of the previous energy inventory reports that have been prepared for London:

- *2020 Community Energy & Greenhouse Gas Inventory,* published on the City of London's Get Involved London website in August 2021.
- *2019 Community Energy & Greenhouse Gas Inventory,* published on the City of London's Get Involved London website in December 2020.
- *2018 Community Energy & Greenhouse Gas Inventory,* prepared by the City of London for the Civic Works Committee in October 2019.
- *2017 Community Energy & Greenhouse Gas Inventory,* prepared by the City of London for the Civic Works Committee in August 2018.
- *2016 Community Energy & Greenhouse Gas Inventory,* prepared by the City of London for the Civic Works Committee in August 2017.
- *2015 Community Energy & Greenhouse Gas Inventory,* prepared by the City of London for the Civic Works Committee in June 2016.
- *2014 Community Energy & Greenhouse Gas Inventory,* prepared by the City of London for the Civic Works Committee in May 2015.
- *2013 Community Energy & Greenhouse Gas Inventory,* prepared by the City of London for the Civic Works Committee in July 2014.
- *2012 Community Energy & Greenhouse Gas Inventory: Challenges & Opportunities,* prepared by the City of London for the Civic Works Committee in October 2013.
- 2011 data was highlighted in the *Environmental Programs Update,* prepared for the Civic Works Committee meeting in May 2012.
- *2008 Energy Use Inventory Report,* prepared by the City of London for the Environment and Transportation Committee in July 2010.
- *2007 Energy Use Inventory Report,* prepared by the City of London for the Environment and Transportation Committee in May 2008.
- *2006 Energy Use Inventory Report,* prepared by the City of London for the Mayor's Sustainable Energy Council in November 2007.
- *1998 Air Emissions and Energy Use in the City of London*, prepared for the London Energy/Air Emissions Reduction Strategy Task Force in March 2000.
- *1990 City of London Air Emissions Study*, prepared by SENES Consultants in association with Proctor and Redfern Limited and Torrie Smith Associates for Vision '96 in September 1995.

4. Community Energy Use

Total energy use in London in 2022 was 58,800 terajoules[1], 14 per cent above 1990 levels, and the same as 2005 levels. As seen from Figure 1, since the mid 2000s, London's total energy use has dropped below the forecasted "business as usual" track forecasted in the 1990s. This illustrates the impact that energy conservation activities over the last 15 years have had decoupling energy use from growth.

Figure 1 - Comparison of Forecast vs. Actual Energy Demand for London



The COVID-19 pandemic continued to have an impact on energy used in London, with overall total energy use in 2021 being two per cent lower than pre-pandemic levels in 2019, as shown in Figure 1 above and Table 1 below.

The main impact was seen in transportation energy use, which was 12 per cent lower than 2019 overall because of many London workplaces shifting to work from home as well as reduced discretionary trips associated with stay-at-home orders and similar restrictions.

Energy used by London's industrial, commercial, and institutional sector increased by seven per cent from the previous year.

Energy used in London's single-family homes was up by six per cent from the previous year. Natural gas use in homes was the main reason, with an increase of ten per cent from the previous year due to colder winter weather increasing the demand for space heating.

[1] A terajoule (or, one trillion joules) is a metric unit for measuring energy, and is approximately equivalent to the energy provided by burning 26,000 litres of gasoline (roughly the amount of gasoline in 500 cars)

Table 1 – 1990-2022 Total Community Energy Use by Sector (Terajoules per Year)

Sector	1990	2005	2019	2022
Transportation	18,200	20,200	21,200	18,800
Residential	13,100	14,800	14,600	14,500
Industrial, Commercial & Institutional (IC&I)	20,200	23,800	24,200	25,600
Total	**51,500**	**58,700**	**60,000**	**58,800**

NOTE: due to rounding of numbers, individual numbers may not add up to the total

London's industrial, commercial, and institutional buildings and facilities accounted for 43 per cent of all energy used in London (Table 2). London Hydro and Enbridge include multi-unit residential buildings (apartment buildings and condominiums) under the category of commercial buildings. Transportation accounted for 32 per cent of all energy used in London, most of which was associated with personal vehicle use. Single family residential homes accounted for 24 per cent of all the energy used in London.

Table 2 – 1990-2022 Share of Community Energy Use by Sector

Sector	1990	2005	2019	2022
Transportation	35%	34%	35%	32%
Residential	25%	25%	24%	25%
Industrial, Commercial & Institutional (IC&I)	40%	40%	40%	43%

The community energy model developed by the Canadian Urban Institute for the Integrated Energy Mapping for Ontario Communities project, combined with latest provincial Broader Public Sector (BPS) energy data (2020 data), was used to estimate a more-detailed breakdown of energy use by building type, as shown in Table 3.

Table 3 – 2022 Estimated Breakdown of Energy Use by Subsector (Terajoules per Year)

Sector	Sub-sector	Energy Use
Transportation	Fuel sold at gas stations	12,500
Transportation	Road freight transport	3,600
Transportation	Corporate fleets	1,100
Transportation	London Transit	300
Transportation	Railway freight transport	600
Transportation	Domestic aviation	600
Residential	Low-density homes	12,000
Residential	Medium-density townhomes	2,400
Industrial, Commercial & Institutional	High-density residential buildings	1,500
Industrial, Commercial & Institutional	Commercial – office buildings	3,200
Industrial, Commercial & Institutional	Commercial – retail (e.g., malls)	5,500
Industrial, Commercial & Institutional	Industrial	11,300
Industrial, Commercial & Institutional	Institutional - schools	500
Industrial, Commercial & Institutional	Institutional - hospitals	1,200
Industrial, Commercial & Institutional	Institutional - colleges & universities	1,500
Industrial, Commercial & Institutional	Institutional - municipal	400
Industrial, Commercial & Institutional	Other	500

Over the 1990-2022 period, London's population has increased by 42 per cent. In 2022 alone, London's population was estimated to have increased by three percent. Energy use per person in London was 135 gigajoules (GJ) per year in 2022, down 19 per cent from the 2005 baseline and 1990 levels as well (Table 4).

Table 4 – 1990-2022 per Person Energy Use by Sector (Gigajoules per person)

Sector	1990 (Pop. 307,000)	2005 (Pop. 349,000)	2022 (Pop. 435,000)	Change from 1990
Transportation	59	58	43	-27%
Residential	43	42	33	-22%
Industrial, Commercial & Institutional (IC&I)	66	68	59	-11%
Total	**168**	**168**	**135**	**-19%**

NOTE: due to rounding of numbers, individual numbers may not add up to the total

Figure 2 – Change in Energy Use in London, Per Person by Sector Since 1990

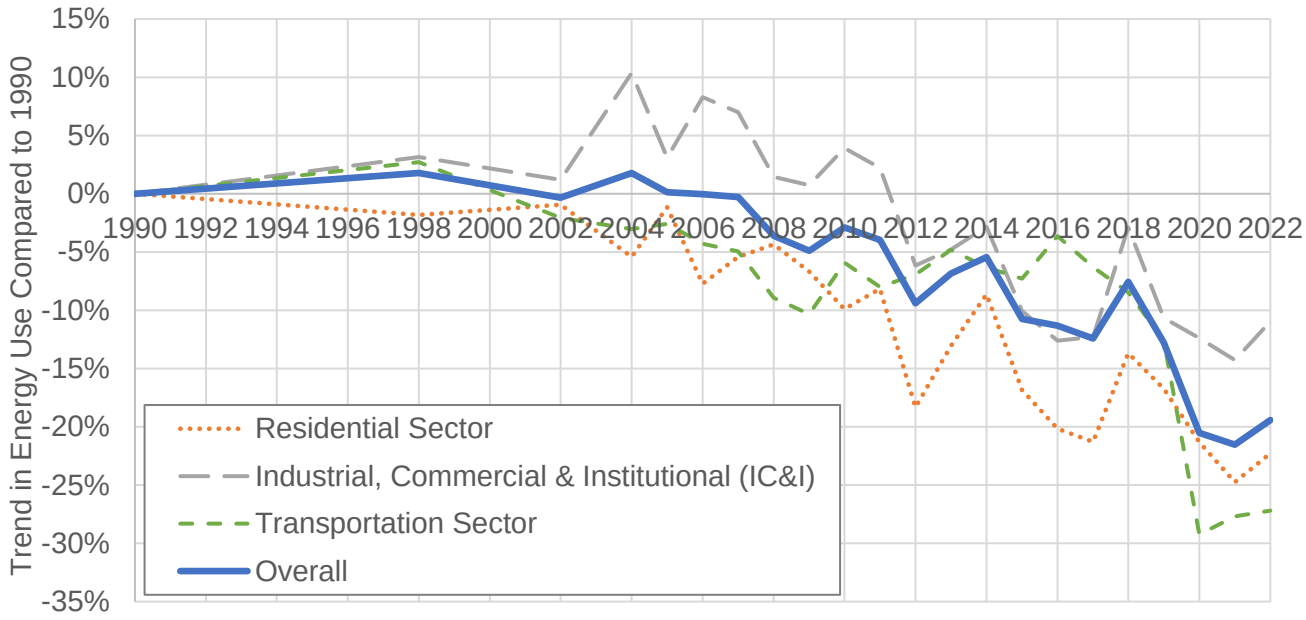


Figure 2 illustrates the change in energy consumption in London by sector on a per person basis, using 1990 as the baseline year. Overall, since the mid 2000s, the trend has been downwards, with the weather-related impacts of the "Winter that Wasn't" of 2012 (very warm winter), the "Polar Vortex" of 2014 (very cold winter), and the combination of a colder winter and warmer summer in 2018 being clearly visible, especially for the residential sector. The major impact of the COVID-19 pandemic on transportation energy use in 2020 and 2021, combined with the warmer than average winter temperatures for those years, is also very apparent.

4.1. Transportation Energy Use

In the early 2010s, transportation energy use was increasing, with the volume of fuel sold in London increasing year-over-year between 2011 and 2016. However, this trend reversed in 2017 and the volume of fuel sold continued to drop through to 2019. This trend may not have been driven by fuel prices since the average fuel prices at the pumps decreased by about 10 cents per litre between 2018 and 2019. Therefore, this could be due to a combination of fewer trips by car and improving vehicle fuel economy.

As noted earlier, the COVID pandemic continued to have a significant impact on transportation energy use in 2022, with the total volume of fuels sold at gas stations being 15 per cent lower in 2022 than it was in 2019.

4.1.1. Registered Vehicles in London

The City started to track local vehicle registration data beginning with 2010 data to try to gain additional insight into transportation energy use.

Prior to COVID-19, vehicle ownership in London had grown by over four per cent every year on average between 2010 and 2019, much faster than London's overall population growth. As of December 2019, there were almost 292,000 light-duty vehicles registered in London – an increase of almost 89,000 since 2010. When compared to Census data on Londoners, vehicle registration increased from 557 vehicles for every 1,000 people in 2010 up to 711 vehicles in 2019.

However, as of December 2022, the number of light-duty vehicles registered in London dropped to over 268,000 vehicles. This works out to 617 vehicles for every 1,000 people.

The vehicle registration data shows a mix of positive and negative trends. On the positive side:

- fuel-efficient compact cars remain the most-popular vehicle segment in London;
- the number of hybrid and/or electric vehicles in London were almost nines times higher in 2022 compared to 2010;
- There are now almost 2,100 electric vehicles registered in London; and.
- 3.2% of new 2022/23 Model Year vehicles registered were electric vehicles and 4.9% were mild hybrid (i.e., no plug) vehicles.

On the negative side, high gas consumption sport utility vehicles and large pick-up trucks continue to gain in popularity as the relative number of minivans and mid-sized sedans declines. Additional detail is provided in Table 5 below.

Table 5 – Vehicle Ownership Statistics for London

Item	**2010**	**2022**	**Change**
Total registered vehicles	202,800	268,400	32%
London's population	364,000 (estimate)	435,000 (estimate)	20%
Vehicles per 1,000 people	557	617	11%
Hybrid gas-electric vehicles (excluding plug-in hybrids)	840	5,320	+ 4,480
Plug-in electric vehicles	0	2,075	+ 2,075
Fuel use per vehicle (GJ/year)	71	47	-34%
Top five vehicle segments (share of vehicle registrations)	compact car (22%) mid-size car (14%) minivan (10%) compact SUV (10%) full-size car (7%)	compact car (20%) compact SUV (18%) mid-size car (8%) large pickup (8%) upper mid-size SUV (7%)	

4.1.2. Transportation Data from Google's Environmental Insights Explorer

The City of London was among the first group of Canadian cities to participate in Google's Environmental Insights Explorer project. This project made use of Google Maps data such as building shapes and mobility data (from tracking the movement of smart phones equipped with GPS) to estimate greenhouse gas emissions from cities.

There are some limitations to this data, in that not everyone travels with a smart phone on hand or with location services enabled on their phone. However, their transportation data has provided some useful insights, namely that trips to/from London (inbound/outbound) have a large impact on emissions even though they are far fewer in number of trips.

The Environmental Insights Explorer tool has provided data up to 2021, which confirmed the impact that COVID-19 has had on transportation. Table 6 summarizes the 2019 to 2021 transportation trip information for London from the Environmental Insights Explorer.

Table 6 – Total Trip Distance Travelled by Mode and Destination for 2019 to 2021

Travel Mode	Destination	2019 Total Trip Distance (km)	2020 Total Trip Distance (km)	2021 Total Trip Distance (km)	2021 Change from 2019
Automobile	Inbound	791,000,000	585,000,000	680,000,000	-14%
Automobile	Outbound	795,000,000	583,000,000	675,000,000	-15%
Automobile	In-Boundary	1,402,000,000	999,000,000	1,167,000,000	-17%
Cycling	In-Boundary	12,000,000	14,500,000	15,300,000	27%
Walking	In-Boundary	53,700,000	42,100,000	46,400,000	-13%
Transit	In-Boundary	56,200,000	39,100,000	31,900,000	-43%
Railway	Inbound	15,200,000	n/a	n/a	n/a
Railway	Outbound	16,600,000	n/a	n/a	n/a

Note that the latest Environmental Insights Explorer data splits the distance travelled for inbound and outbound trips evenly between the origin and destination to avoid double-counting. For example, the distance covered by an automobile trip from London to Toronto would be split evenly between London and Toronto.

Cycling has seen strong growth in total distance travelled, with a 27 per cent increase from 2019 levels in 2021. Increases in cycling were also seen in other Ontario cities with Environmental Insights Explorer data. This has been noted in cities world-wide, with the reduction of vehicle traffic on roads encouraging more people to use bicycles for transportation, along with the emerging popularity of electrically assisted bicycles (e-bikes). Trips made by automobile did increase in 2021 compared to 2020 but were still below pre-pandemic levels of 2019.

This highlights the importance of City-led transportation initiatives such as rapid transit and the Cycling Master Plan. According to London's *Smart Moves 2030 Transportation Master Plan*, around 74 per cent of all personal trips made in London during the weekday peak periods in 2009 were made in personal vehicles, and 86 per cent of these vehicles only have one occupant – the driver.

4.2. Energy Use and the Local Economy

Energy use per person related to the industrial, commercial, and institutional sector in 2022 was 11 per cent lower than 1990. London Hydro and Enbridge have also been increasing efforts to promote energy conservation and demand management with their business client base.

Another way to measure improvements in energy efficiency of the local economy is to compare it to Gross Domestic Product (GDP). Since 1990, London's GDP has grown significantly. Using

statistics from the London Economic Development Corporation (LEDC) and the Conference Board of Canada, London's GDP (in constant 2012 dollars – i.e., excluding inflation) has grown by 100 per cent between 1990 and 2022.

Using these GDP estimates for 1990, London's energy productivity - GDP generated per unit energy used in London's employment sector - has improved by 58 per cent. Table 7 illustrates this in more detail. This means that local businesses are producing products and services more efficiently and/or moving towards producing products and services of higher value for the same amount of energy used.

A number of London's major employers have taken a leadership position on energy management, but there are still many opportunities to reduce energy use in the employment sector, particularly amongst small-to-medium sized enterprises who may not have the human, financial, and/or technical resources to manage their energy use effectively.

Table 7 – 1990-2022 Energy Productivity of London's Employment (IC&I) Sector

Indicator	1990	1998	2007	2022
Gross Domestic Product ($ millions GDP[1])	$10,600[2]	$12,800[2]	$16,900	$21,200
Energy Used by IC&I Sector (Terajoules - TJ)	20,200	22,500	25,100	25,500
Energy Productivity ($GDP per Gigajoules - GJ) [3]	$524	$569	$675	$830
Improvement in Productivity Since 1990		9%	29%	58%
Average Annual Productivity Improvement		1.0%	1.9%	1.3%

4.3. Energy Commodities Used in London

The breakdown of energy use and GHG emissions by commodity is outlined in Table 8. Natural gas was the largest source of energy used in London in 2022, accounting for 47 per cent of all energy used. Gasoline was the second largest source of energy, accounting for 21 per cent of London's energy use. Electricity accounted for 20 per cent of all the energy used in London.

1 – GDP data based on the London Census Metropolitan Area (includes St. Thomas & Strathroy), prorated by 77% based on population of London, and adjusted to constant 2012 dollars based on the Consumers Price Index (CPI) for Ontario
2 – Extrapolated from 2007 GDP data for London CMA based on changes to Ontario's real GDP for 1990 and 1998
3 – London's GDP divided by energy used in IC&I sector

Compared to 2021, 2022 had an overall colder winter, which increased the demand for natural gas used for heating.

For electricity, it is important to note that about 90 per cent of the electricity generated in Ontario comes from emissions-free sources. In 2022, as reported by the Ontario Energy Board, 51 per cent of Ontario's electricity was supplied by nuclear generating stations, while hydroelectric generating stations supplied 25 per cent and other renewable sources of electricity (wind, biomass, solar) provided 14 per cent of our electricity needs. Natural gas-fired generating stations provided ten per cent of Ontario's supply.

Table 8 – 2022 Community Energy Use by Energy Commodity

Energy Commodity	Total Used	Energy (Terajoules)	Energy (%)
Natural Gas	738,300,000 m^3	27,500	47%
Gasoline[1]	349,500,000 L	12,100	21%
Electricity	3,254,000 MWh	11,700	20%
Diesel[1,2]	124,000,000 L	4,800	8%
Aviation fuel[2]	17,000,000 L	600	1%
Propane[1]	33,300,000 L	800	> 1%
Ethanol (blended into gasoline)	32,900,000 L	600	1%
Fuel Oil[1]	13,200,000 L	500	1%
	Total	**58,800**	

NOTE: due to rounding of numbers, individual numbers may not add up to the total
1 – includes some data prorated from Ontario consumption data provided by Statistics Canada; 2019 data
2 – aviation and freight fuel data prorated from Canada consumption data provided by Statistics Canada; 2020 data

However, one important concept that needs to be understood is thermal efficiency. Whenever any fuel is burned in an engine to create mechanical energy or used to make steam to spin a turbine to generate electricity, only a small portion of thermal energy ends up being converted to mechanical or electrical energy. The rest of the energy often ends up being lost as "waste heat". For example, the amount of thermal energy converted into power by steam-driven turbines in electricity generating stations is usually about 33 per cent, or in other words you need to use three units of heat energy to make one unit of electrical energy. The conversion rate is higher for combined cycle gas-fired power plants, which can reach about 50 per cent conversion of heat energy into electricity.

This is the same for internal combustion engines used in vehicles, which are about 35 per cent efficient when running in highway driving, and about 20 per cent efficient overall when you take

into account the fuel wasted in city driving associated with waiting at stop lights and other situations where the engine idles. Replacing internal combustion vehicles with battery-powered electric vehicles is more efficient overall, even more so when sources like hydroelectricity are used.

When the thermal efficiency of converting heat into power in electricity generating stations is considered, a different picture of energy needs emerges, as seen in Table 9.

Table 9 – 2022 Energy Use in Electricity Generation Accounting for Thermal Efficiency

Source of Energy[1]	Energy (Terajoules)	Energy (%)
Uranium[2]	18,300	72%
Hydroelectric	3,000	12%
Natural Gas[3]	2,400	10%
Wind	1,180	5%
Solar[4]	290	1.2%
Biofuels[2]	140	0.6%
Total	**25,000**	

NOTE: due to rounding of numbers, individual numbers may not add up to the total
1 – Based on IESO 2019 annual electricity generation data from transmission-connected sources
2 – Assumed 33% thermal efficiency for generating electricity
3 – Assumed 50% thermal efficiency for generating electricity
4 – IESO data for solar only includes large transmission-connected solar farms. The Ontario Energy Board estimates that solar PV accounts for over 2% of power generation when smaller, local embedded generation is included

Table 9 helps illustrate the fact that electricity is not an energy resource, but the conversion of one form of energy (e.g., thermal energy in the case of nuclear and natural gas, gravitational potential energy in the case of hydroelectricity, kinetic energy in the case of wind) into electrical energy. In most cases, the remaining heat from large electricity generation plants is wasted. For London's electricity needs, 25,000 terajoules of energy resources were consumed to provide London with 11,700 terajoules of electricity – the remaining 13,300 terajoules of energy was waste heat that was not utilized. However, this table helps to illustrate that greater use of cogeneration (or combined heat and power) and non-fuel renewables (hydro, wind, solar) will help to reduce this waste. Note that there are other "losses" that occur in energy distribution, such as line losses from power transmission, which have not been quantified.

Table 10 outlines the trend in per person energy commodity use since 1990.

Table 10 – 1990-2021 per Person Energy Use by Energy Commodity (GJ per Person)

Energy Commodity	1990 (Pop. 307,000)	2005 (Pop. 349,000)	2022 (Pop. 435,000)	Change from 1990
Natural Gas	67	69	63	-5%
Gasoline (including ethanol-blended gasoline)	41	40	29	-28%
Electricity	34	37	27	-22%
Diesel	13	13	11	-14%
Fuel Oil	7.2	4.2	1.2	-84%
Aviation fuel	3.2	2.6	1.5	-53%
Propane	2.4	1.7	1.9	-20%
Total	**168**	**168**	**135**	**-20%**

NOTE: due to rounding of numbers, individual numbers may not add up to the total

5. Energy Expenditures and Energy Generation

5.1. Energy Expenditures in London

Using information on utility billing rates and fuel price data from Kalibrate (formerly Kent Group), the total cost of energy use can be estimated. Note that these costs also include costs for the distribution and delivery of the energy commodity, as well as taxes on these commodities. A full description of the methodology is outlined in Appendix A (Section A.3). Energy use and associated expenditures on energy are a significant operating cost for many businesses. In addition, for many Londoners, the rising costs of gasoline and electricity have put pressure on day-to-day household expenses, often requiring households to cut back on discretionary purchasing.

Understanding how much is collectively spent on energy, and the opportunities arising from energy conservation, is important for London. Table 11 outlines the total estimated costs associated with the energy commodities used in London.

Table 11 – Total Estimated Cost by Energy Commodity in 2022

Energy Commodity[1]	Cost ($ million)	Share (%)	Energy (terajoules)	Price per gigajoule
Gasoline (including ethanol-blends)	$619	33 %	12,800	$48
Electricity	$515	28 %	11,700	$44
Natural Gas	$447	24 %	27,500	$16
Diesel[1]	$214	12 %	4,800	$45
Propane	$25	1 %	800	$32
Fuel Oil	$30	2 %	500	$59
Total	**$1,850**		**58,800[1]**	**$31**

NOTE: due to rounding of numbers, individual numbers may not add up to the total
1 – excludes diesel for railway freight transportation and aviation fuels

In recent years, it was estimated that Londoners normally spend around $1.5 billion per year on energy. However, with the high global fossil fuel costs triggered by the Russian invasion of Ukraine, it is estimated that Londoners spent $1.85 billion on energy in 2022, an increase of 37 per cent from 2021.

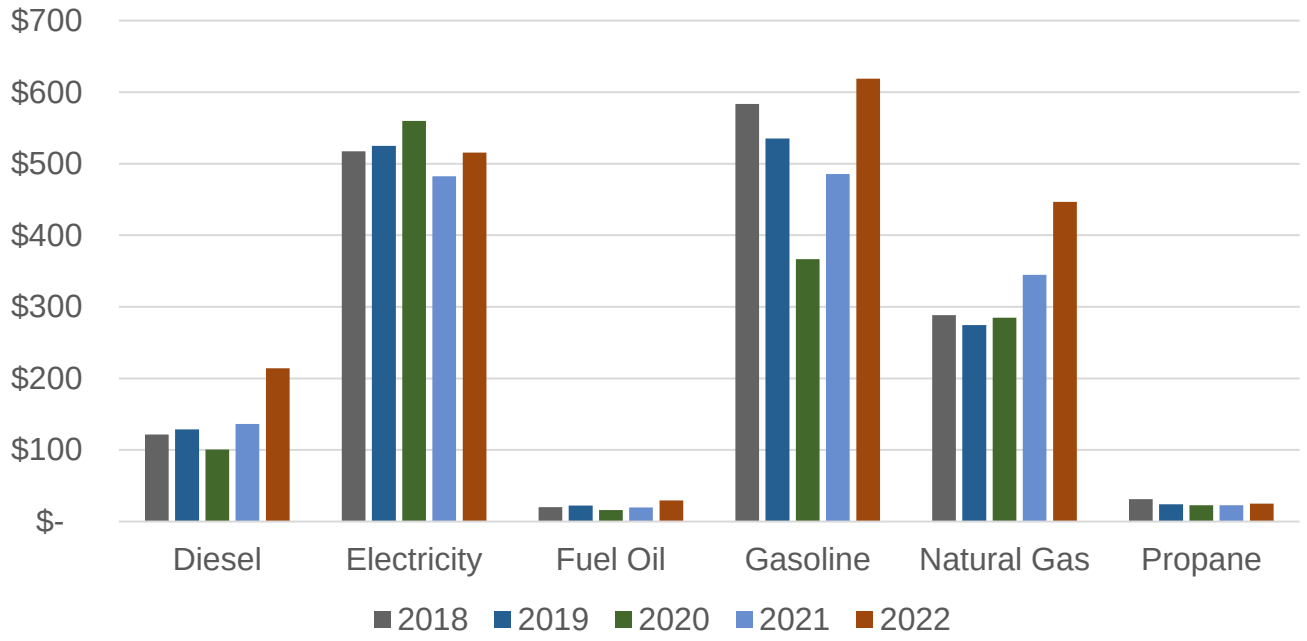
The average price for gasoline in 2022 increased by 28 per cent from the previous year. In total, Londoners spent about $130 million more on gasoline in 2022 than they did in 2021.

These high prices may have contributed to gasoline sales remained well below pre-pandemic levels in 2022.

Electricity accounted for 28 per cent of total energy costs in 2022. In total, Londoners spent about $33 million more on electricity in 2022 than they did the previous year.

Natural gas use accounts for 24 per cent of energy costs, even though it was the largest source of energy we used. Natural gas is still the lowest cost energy source, even with the $50 per tonne carbon price in place during 2022. However, natural gas prices overall were 19 per cent higher than the previous year. Colder winter weather in 2022 increased the demand for natural gas for building heat.

Figure 3 – Trend for Total Energy Commodity Costs (Millions) by Commodity in London



It is important to note that costs could have been higher. If 2010 is used as a baseline year in terms of energy use per capita, as noted in Figure 4, recent improvements in energy efficiency have created ongoing savings. In 2022, it is estimated that $510 million in energy costs were avoided through energy efficiency as well as continued COVID-19-related reductions in transportation fuel use. Added up year-over-year, London has avoided almost $2.3 billion in energy costs due to improved efficiency since 2010.

On average, every percentage that Londoners reduce their energy use results in around $12 million staying in London every year.

Information from utility billing rates and fuel price data can also be used to provide a reasonable estimate where the money is spent by Londoners on energy, as illustrated in Table 11. Out of the $1.85 billion spent on energy in 2022, it is estimated that 15 per cent of this money stayed in London, most of which goes towards London Hydro's and Enbridge's local operations. The rest leaves London.

With the high global oil commodity prices due to the Russian invasion of Ukraine, Western Canada's share of our energy dollars increased. In 2022, Londoners and London businesses sent about $460 million of their energy dollars to Western Canada compared to about $180 million in 2020.

About $370 million of our energy dollars also go to electricity generators in Ontario like Bruce Power and Ontario Power Generation, as well as Ontario's primary electricity transmitter, Hydro One.

Figure 4 – Trend for London's Total Energy Costs (Millions) Compared to 2010 Energy Efficiency Baseline

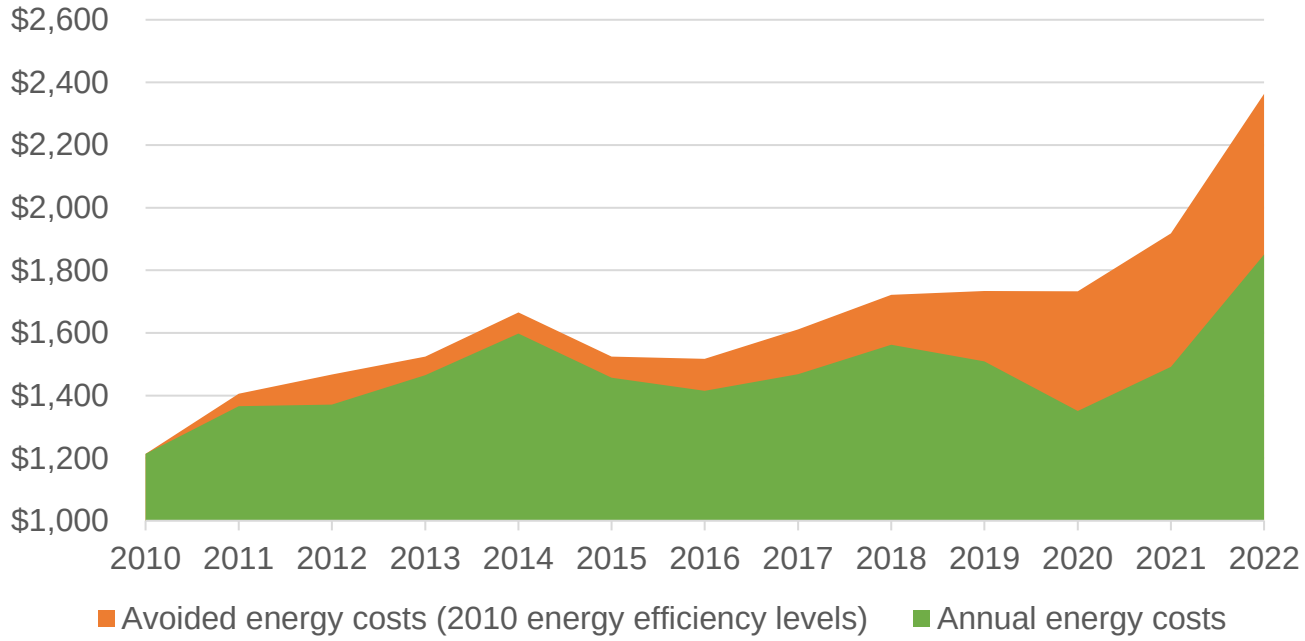


Table 11 – Estimated Share of Energy Revenue (2022)

Commodity	London Region	Ontario - Business	Ontario - Government	Western Canada	Canada - Government	United States
Diesel	1%	3%	2%	5%	1%	-
Electricity	4%	20%	3%	-	1%	-
Fuel Oil	<1%	<1%	<1%	<1%	<1%	-
Gasoline	3%	6%	5%	15%	3%	-
Natural Gas	5%	2%	5%	4%	1%	6%
Propane	<1%	<1%	<1%	-	<1%	-
Total	**15%**	**33%**	**15%**	**25%**	**6%**	**6%**

NOTE: due to rounding of numbers, individual numbers may not add up to the total

A portion of the money collected from federal and provincial taxes and other utility bill fees does help pay for other government services in London. For example, the City of London gets a portion of the gasoline tax to help pay for improvements to local transportation, other infrastructure, and environmental projects. Also, energy conservation incentives offered by utility companies are funded through utility bills, as it is usually more economical to invest in conserving energy rather than build new power plants.

The federal government also applies their carbon pollution pricing backstop in Ontario given that Ontario no longer has a carbon pricing system in place. Most of the funds collected by the backstop are used for the Climate Action Incentive provided when filing personal income tax returns, with the remaining used for funding federal climate action programs such as the Incentives for Zero-Emission Vehicles program. City staff estimate that about $125 million was collected through the carbon pricing backstop in 2021.

5.2. Energy Generation in London

London has 93.2 megawatts (MW) of local electricity generation and 8.2 megawatts of battery electricity storage system capacity installed to date. Currently, there are 68.4 megawatts of gas-fired cogeneration, 20.3 megawatts of solar photovoltaic (PV), 3.8 megawatts of biogas, and 0.68 megawatts of hydro-electric power generation in operation in London.

Most of London's local generating capacity is associated with natural gas combined heat and power cogeneration plants, used in four different applications:

- **District energy** - London District Energy is a "merchant plant" that sells the power to the Independent Electricity System Operator and the thermal energy (steam for heating, chilled water for cooling) to buildings in downtown and central London. London District Energy has recently doubled its capacity to deliver combined heat and power at its Colborne Street facility.

- **Industrial** – Ingredion and Labatt Brewery generate steam as well as electricity "behind-the-meter" for use in their operations.

- **Hospital campus** – the London Health Sciences Centre Victoria Hospital campus generates both steam and electricity for hospital buildings, including the ability to keep the heat and power infrastructure operational in the event of an emergency.

- **Micro-scale** – small scale combined heat and power systems (under 100 kilowatts) are in use at the Canada Games Aquatic Centre for pool heating as well as electricity "behind-the-meter" for use in their operations.

6. Translating Energy Use into Greenhouse Gas Impact

6.1. Greenhouse Gas Emissions for 2022

Energy use in London was responsible for almost 2.6 million tonnes of greenhouse gas (GHG) emissions (expressed in terms of equivalent carbon dioxide, or CO_2e) in 2020. Table 12 provides additional information on GHG emissions associated with the various sources of energy used in London.

Table 12 – 2022 GHG Emissions by Energy Commodity

Energy Commodity	Energy (Terajoules - TJ)	GHG Emissions (kilotonnes CO_2e)	GHG (%)	GHG Intensity (tonnes/TJ)
Natural Gas	27,500	1,400	50%	51
Gasoline (including ethanol)	12,800	810	29%	63
Diesel	4,800	340	12%	70
Electricity	11,700	140	5%	12
Aviation Fuel	600	40	2%	68
Propane	800	50	2%	61
Fuel Oil	500	40	1%	70
Total	**55,400**	**2,820**		

NOTE: due to rounding of numbers, individual numbers may not add up to the total

Energy use is responsible for 95 per cent of all GHG emissions from human activity in London. Not only does burning fossil fuels such as gasoline, diesel, and natural gas produce carbon dioxide – the most common GHG associated with human activity – but the use of electricity also contributes to GHG emissions.

About 90 per cent of Ontario's electricity was generated from emissions-free sources in 2022, such as nuclear and hydro-electric generating stations as well as renewable sources (wind and solar). However, as reported by the Ontario Energy Board, Ontario relied on fossil fuels such as natural gas to generate over ten per cent of the electricity we use, a higher share than in recent years.

The remaining five per cent of GHG emissions are methane emissions from the anaerobic decomposition of organic materials in the active and closed landfills located in London as well

as commercial sector waste disposed in landfills outside London, and nitrous oxide emissions from sewage sludge incineration.

The City of London's new Climate Emergency Action Plan has set new, science-based GHG reduction targets for community-wide emissions:

- a 55% reduction from 2005 levels by 2030;
- a 65% reduction by 2035;
- a 75% reduction by 2040; and
- net-zero emissions by 2050.

The Climate Emergency Action Plan adopted 2005 (versus 1990) as the new baseline year for community GHG emissions reduction targets given that:

- 2005 is the baseline year used for target setting by the Government of Canada and the Province of Ontario; and
- 2005 represents a year where per-person emissions in London were close to their peak (the basis for setting a 1.5°C science-based target).

In April 2021, the federal government revised its 2030 target to aim for a 40 to 45 per cent reduction in GHG emissions from 2005 levels as well as net-zero emissions by 2050. To date, the provincial government has not revised its 2030 target for a 30 per cent reduction from 2005 levels and has not established an emission reduction target beyond 2030.

In 2022, total GHG emissions were estimated to be 2.96 million tonnes of equivalent carbon dioxide, or 24 per cent lower than the 2005 level. However, it is important to note the extraordinary impact of the COVID-19 pandemic on emissions.

As mentioned earlier, the COVID-19 pandemic continued to have a significant impact on transportation fuel use, with transportation GHG emissions in 2022 12 per cent below pre-pandemic levels.

Colder winter weather in 2022 compared the year before increased the demand for natural gas used for heating, with an associated 12 per cent increase in residential GHG emissions. Seasonal weather variations can affect energy use and associated emissions significantly. However, over the last ten years, winter average temperatures and most summer average temperatures have been warmer than normal (as defined by Environment Canada's 1971-2000 climate data for London - see Appendix B).

In 2022, it is estimated that every 1,000 kilowatt-hours of electricity generated in Ontario produced 43 kilograms of carbon dioxide emissions. This is significantly better than it was 20 years ago (2003), when electricity generated in Ontario produced around 300 kilograms of carbon dioxide emissions. However, this does represent an increase in electricity emissions intensity from recent years when emissions were at or below 30 kilograms per 1,000 kilowatt-hours. As a result, this increase in emissions intensity is responsible for an additional 45,000 tonnes of emissions attributable to London in 2022 – 1.6 per cent higher.

Figure 5 illustrates the total GHG emission trend since 2005 in comparison to the targets used for London, for Ontario, and for Canada (with the minimum 40 per cent reduction target shown in the chart). Since 2005, there has been a downward trend driven by a combination of cleaner electricity generation and improved energy efficiency. However, since 2018, emissions to date have been above the trendline needed to meet our new science-based targets.

The cancellation of provincial renewable electricity contracts and electric vehicle incentives may have contributed to the loss of momentum. As noted earlier, London's emissions in 2022 would have been 45,000 tonnes lower had the emissions intensity of Ontario's electricity grid remained unchanged. For 2022 electric vehicle sales, as of the third quarter of 2022, Ontario's EV market share of 6.0 per cent was below the national average of 7.7 per cent and far behind British Columbia and Quebec at 15.6 per cent and 11.8 per cent respectively. London's EV market share is even lower, at 3.2 percent in 2022, due to the low availability of EVs in smaller markets like London.

Figure 5 - Targets vs. Actual GHG Emissions from London

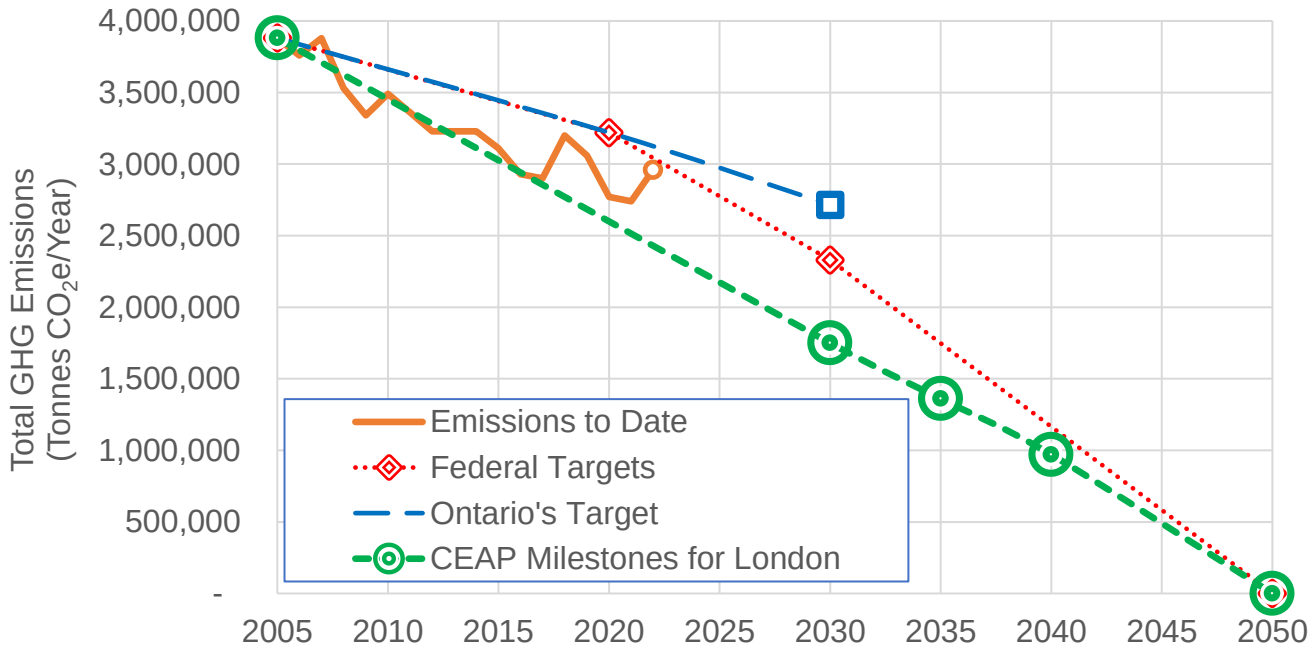


Table 13 illustrates the GHG emissions trends by sector, including landfill gas emissions. As seen in Table 13, transportation and the industrial, commercial, and institutional sectors have the greatest contribution.

Table 13 – 2005-2022 Community GHG Inventory in London (kilotonnes CO_2e per year)

Sector	2005	2015	2022
Transportation	1,400	1,420	1,220
Residential	850	570	570
Industrial, Commercial & Institutional	1,380	900	1,020
Landfill Gas Emissions & Sewage Incineration	250	220	140
Total	**3,880**	**3,100**	**2,960**

NOTE: due to rounding of numbers, individual numbers may not add up to the total

The community energy model developed by the Canadian Urban Institute for the Integrated Energy Mapping for Ontario Communities project, combined with provincial Broader Public Sector (BPS) energy data, was used to estimate a more-detailed breakdown of GHG emissions by building type, as shown in Table 14.

In terms of per person emissions, as illustrated in Table 15 and Figure 6, emissions today are 39 per cent lower than they were back in 2005 (11.1 tonnes per person in 2005 versus 6.8 tonnes per person in 2022).

This reduction in GHG emissions resulted from reduced GHG intensity of Ontario's electricity grid, improved home energy efficiency, reduced energy use in the business sector, and the improvement of the City of London landfill gas collection and flaring system at the W12A Landfill. Transportation emissions were also lower due to improved fuel efficiency, reductions in commuting due to the COVID-19 pandemic, the use of ethanol-blended gasoline (10% ethanol by volume), as well as vehicle tailpipe emission controls that reduced emissions of nitrous oxide.

Table 14 – 2022 Breakdown of GHG Emissions by Subsector

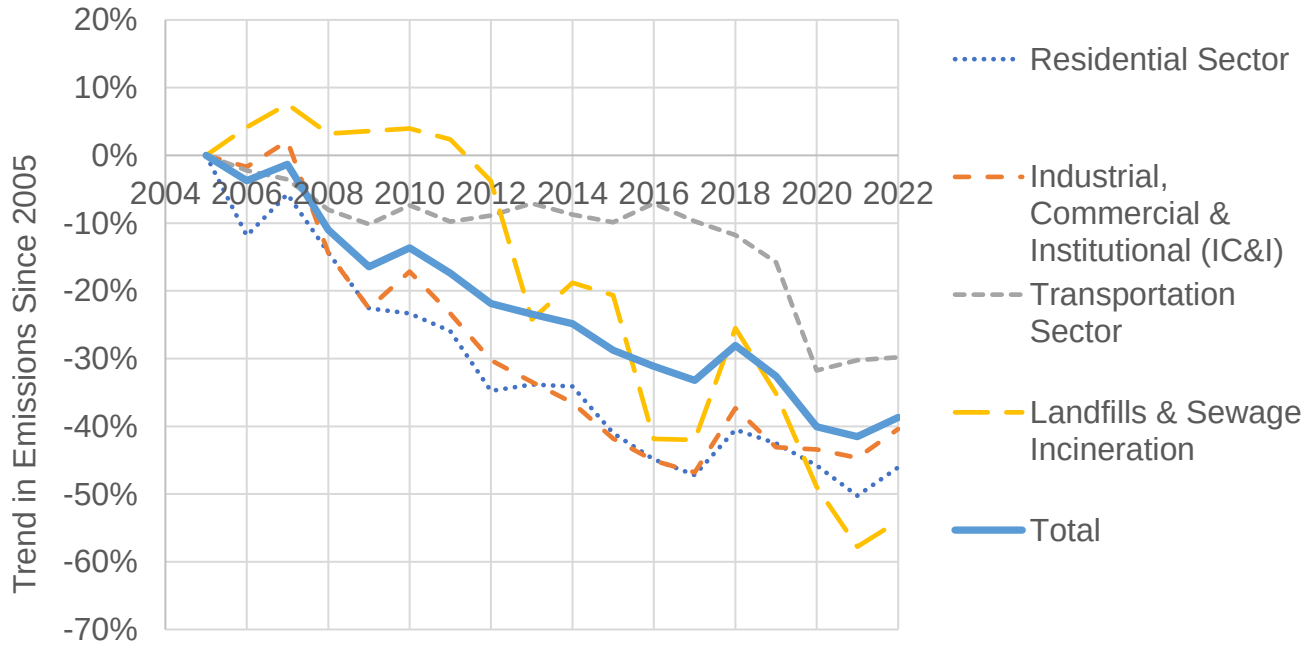
Sector	Sub-sector	GHG Emissions (kilotonnes per year)
Transportation	Fuel sold at gas stations	790
Transportation	Road freight transport	250
Transportation	Corporate fleets	80
Transportation	London Transit	20
Transportation	Railway freight transport	40
Transportation	Domestic aviation	40
Residential	Low-density homes	490
Residential	Medium-density townhomes	80
Industrial, Commercial & Institutional	High-density residential buildings	40
Industrial, Commercial & Institutional	Commercial – office buildings	130
Industrial, Commercial & Institutional	Commercial – retail & warehouses	210
Industrial, Commercial & Institutional	Industrial & other	500
Industrial, Commercial & Institutional	Institutional - schools	20
Industrial, Commercial & Institutional	Institutional - hospitals	50
Industrial, Commercial & Institutional	Institutional - colleges & universities	60
Industrial, Commercial & Institutional	Institutional - municipal energy use	10
Waste Management	W12A Landfill	80
Waste Management	Closed landfills	30
Waste Management	IC&I waste disposed outside London	20
Wastewater Treatment	Sewage sludge incineration	8

Table 15 – 2005-2022 per Person GHG Inventory in London (tonnes per person)

Sector	2005 (Pop. 349,000)	2015 (Pop. 381,000)	2022 (Pop. 435,000)	Change from 2005
Transportation	4.00	3.60	2.81	-30%
Residential	2.45	1.44	1.32	-46%
Industrial, Commercial & Institutional	3.94	2.30	2.35	-40%
Landfill Gas Emissions & Sewage Incineration	0.70	0.56	0.32	-54%
Total	**11.1**	**7.9**	**6.8**	**-39%**

NOTE: due to rounding of numbers, individual numbers may not add up to the total

Figure 6 – Change in GHG Emissions in London, Per Person by Sector, Since 2005



It is important to note these GHG emissions estimates do not include emissions (indirect emissions) associated with the extraction, production, and transportation of materials, fuels, food, and consumer products (e.g., emissions from produce grown and transported from California, consumer products made and transported from China). This is consistent with the approach taken by other Canadian cities reporting GHG emissions through the Partners for Climate Protection program. However, it is important to recognize the fact that the production and transportation of consumer goods purchased do have an environmental impact, and that some types of goods (e.g., meat and dairy products) do have a larger impact than others. Additional information on consumption-related household GHG emissions is provided in Section 7 – Household Energy Use and Emissions.

6.2. Publicly Reported Local Emitters

The provincial government requires facilities that emit more than 10,000 tonnes of greenhouse gases per year to report their emissions on an annual basis. The most recent data available is 2021. In London, there are eight facilities that have reported their emissions, including Fanshawe College who report voluntarily, as shown in Table 16. Note that these are direct "Scope 1" emissions from stationary fossil fuel use only, and do not include emissions associated with electricity use or vehicle fuel use.

The district heating steam plant at Western University provides heat for buildings on the Western University campus as well as the neighbouring London Health Sciences Centre University Hospital. In the case of London District Energy, reported emissions are associated with providing steam heating and chilled water to buildings, as well as generating electricity. Many building owners served by London District Energy, including the City of London and St. Joseph's Health Care, include their share of these emissions within their energy and GHG reporting to the Province of Ontario through Ontario Regulation 397/11, as shown in Table 17.

It is important to note that these "large emitters" accounted for 16 per cent of London's total GHG emissions.

Table 16 – Annual GHG Emissions from Reporting Facilities (tonnes CO_2e per year)

Reporting Facility	2010	2015	2021
Fanshawe College of Applied Arts and Technology	3,143	2,927	2,564
3M Canada	N/A	N/A	10,811
Ingredion Canada Incorporated	124,320	124,263	127,987
Labatt Breweries of Canada LP	26,594	25,352	24,148
London Health Sciences Centre (Victoria Campus)	37,108	47,263	54,539
Western University (steam plant)	51,364	52,615	47,708
London District Energy	39,844	47,554	81,350
Great Lakes Copper	N/A	12,866	12,940
Kaiser Aluminum	N/A	N/A	17,901
W12A Landfill – Corporation of the City of London	160,430	155,873	73,000
Greenway Pollution Control Centre – Corporation of the City of London	N/A	N/A	3,797
Total	**442,803**	**468,713**	**456,745**
Percentage of total emissions from London	**13%**	**15%**	**16%**

The institutional sector – municipal government, colleges and universities, schools, hospitals – is also required to report its energy use and associated GHG emissions to the Province of

Ontario through Ontario Regulation 397/11. These emissions are for the organization as a whole, not just one specific facility or building. Table 17 summarizes the data reported for 2020, the most recent information available from the provincial government. Note that this information will include emissions from electricity use but does not include emissions from vehicle fuels. Also, in the case of the City of London, the Province's reporting requirements do not require electricity use for street lighting and sports field lighting to be reported.

Table 17 – Ontario Regulation 397/11 Reporting Organizations in London

Reporting Organization (based on building electricity and fuel use)	**Annual GHG Emissions 2020 (tonnes CO_2e)**
University of Western Ontario	49,342
London Health Sciences Centre	50,841
Thames Valley District School Board	11,643
St. Joseph's Health Care London	13,700
City of London	8,930
Fanshawe College	4,560
London District Catholic School Board	3,808
Conseil scolaire de district des écoles catholiques du Sud-Ouest	424
County of Middlesex (buildings in London)	501
Conseil scolaire de district du Viamonde	251
Collège Boréal	2
total	**144,003**
Percentage of industrial, commercial, and institutional emissions	**15%**
Percentage of total emissions from London	**5%**

7. Household Energy Use and Emissions

Providing estimates of energy use and greenhouse gas emissions for an average household in London offers a clearer understanding of the current situation (i.e., what to focus efforts on) and identifies opportunities for improvements. These estimates can be made using the following assumptions:

- For electricity and natural gas, divide the total residential customer energy use by the number of customers;
- For gasoline, divide the total retail sales of gasoline by the number of households in London; and
- For propane, divide the estimated total residential use of propane by the number of households in London.

Electricity and natural gas use can be broken down further based on provincial data on typical energy use breakdown in Ontario homes. Greenhouse gas emissions from organic waste in curbside waste can be estimated by dividing the annual GHG emissions from the W12A Landfill by the number of households in London. Note that these estimates best reflect those Londoners who live in single-family homes.

Table 18 – Estimated Average Household Energy Use and Emissions in London for 2022

Household Activity	Average Monthly Use over the Year	Average Monthly Cost over the Year	Average Annual Cost	Average GHG Emissions (tonnes CO_2e)
Gasoline use (vehicles)	162 litres	$275	$3,300	4.0
Natural gas use	175 m^3	$112	$1,340	4.0
Home heating		*$86*	*$1,030*	*3.1*
Hot water heating		*$26*	*$310*	*0.9*
Electricity use	680 kWh	$120	$1,440	0.35
Air conditioning		*$16*	*$190*	*0.05*
Appliance & plug load		*$39*	*$470*	*0.11*
Lighting		*$12*	*$140*	*0.03*
HVAC fan motor		*$54*	*$650*	*0.16*
Propane use	5 litres	$11	$130	0.1
Food waste in garbage		n/a	n/a	0.6
Total		**$518**	**$6,210**	**9.2**

NOTE: due to rounding of numbers, individual numbers may not add up to the total

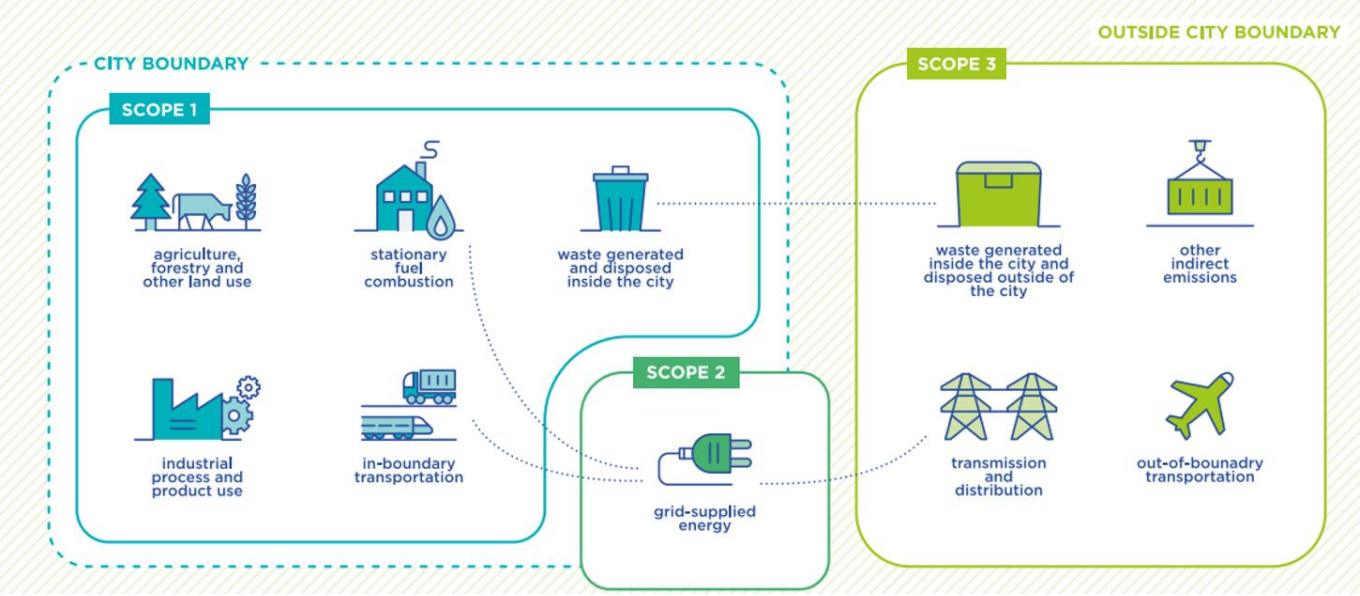
7.1. Consumption (Scope 3) Greenhouse Gas Emissions

Scope 1 and 2 community greenhouse gas emissions from energy used by Londoners and London's businesses and institutions, as well as other local sources of greenhouse gas emissions (i.e., methane from landfills and nitrous oxides from wastewater treatment) are what is traditionally reported by municipalities.

However, this does not provide the full picture regarding the impacts Londoners have on our climate. Many of the goods and services Londoners use, such as gasoline refined from synthetic oil extracted from Alberta's tar sands and produce grown in California, create emissions all along their supply chains on the way to London. These emissions are referred to as Scope 3 emissions for London.

A consumption-based inventory includes the emissions embedded in the goods and services consumed in the city. This includes the direct emissions of households and personal transportation in the city (i.e., Scope 1 emissions), plus the emissions embedded in the goods and services consumed within the city, regardless of where the goods and services are produced.

Figure 7 - Illustration of Scope 1, 2, and 3 Emission Sources

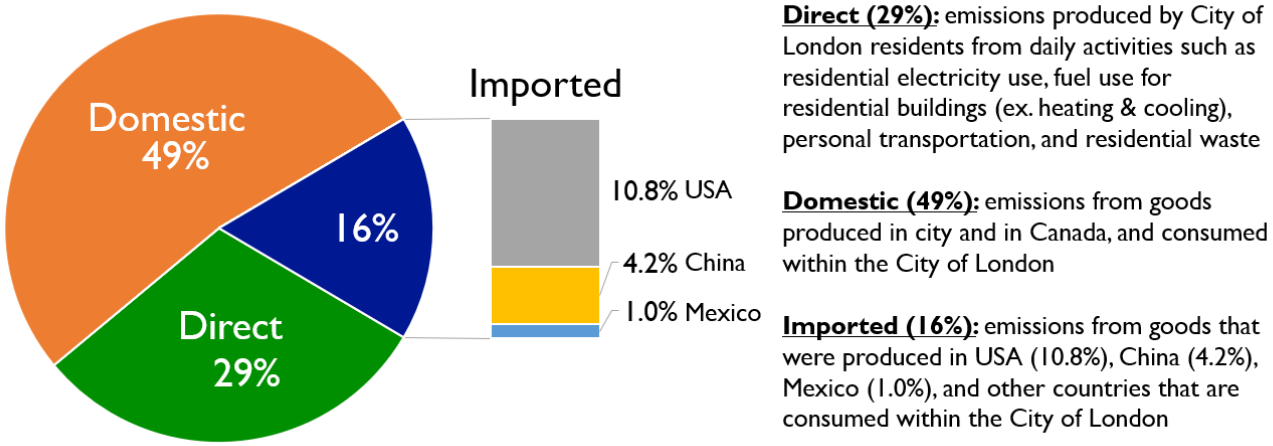


(Source: Consumption-Based GHG Emissions of C40 Cities)

The calculation of detailed consumption-based inventories is a complex undertaking. However, Corporate Knights, a Canadian sustainable-economy media and research corporation, has developed a simplified method for developing a high-level estimate of consumption-based emissions at the city scale. City staff worked with Corporate Knights to apply their methodology to London, Ontario. For more information on consumption-related emissions were, please refer to the Consumption-based Greenhouse Gas (GHG) Emissions - City of London report in Appendix D of the Climate Emergency Action Plan 2022 Progress Report.

As shown in Figure 8 below, London's total consumption-based greenhouse gas emissions per person are estimated to be over three times higher than a person's direct (Part 1) emissions. About half of the consumption-based emissions are associated with domestic goods and services, including those within London. Imported goods and services accounted for 16 per cent, with the United States and China making up the majority of import-related emissions.

Figure 9 - Breakdown of London's Consumption-Related GHG Emissions in 2019



(Source: Corporate Knights - Consumption-based Greenhouse Gas (GHG) Emissions - City of London report)

The Corporate Knights report does not provide details regarding what contributes to London's consumption-related emissions. However, the Environmental Commissioner of Ontario report (March 2019), *Climate Pollution: Reducing My Footprint*, included estimates of consumption related GHG emissions per person for Ontario residents as shown in Table 19. Note that these estimates do not include broader economy-related emission sources that were included within the Corporate Knights report.

Table 19 – Estimated Average Household Consumption-Relation GHG Emissions in London

Household activity or purchases	Average Annual Lifecycle GHG Emissions (tonnes CO_2e per household)
Air travel – domestic	0.4
Air travel – international	2.7
Food – beef (e.g., enteric fermentation, processing, transportation)	1.1
Food – other (e.g., fertilizer, farm fuel use, processing, transportation)	2.0
Home – raw material extraction & processing, home construction	0.7
Home – natural gas extraction & processing, pipeline transportation	1.2
Other purchased goods & services (e.g., clothing, electronics, internet)	7.0
Vehicle – raw material extraction & processing, parts manufacturing & assembly	1.6
Vehicle fuel – oil extraction, fuel refining, pipeline transportation	1.0
Total Consumption (Scope 3) Emissions	**17.7**

In summary, greenhouse gas emissions associated with the manufacturing and delivery of goods and services used by Londoners is larger than the emissions from the direct use of energy and from waste. This highlights the climate change mitigation significance of several environmental initiatives such as:

- Food waste reduction;
- Buying durable products;
- Buying local products;
- Recycling and the circular economy (end-of-product-life material recovery and reuse); and
- Repurposing and renovating existing buildings.

8. Hydrofluorocarbons

Hydrofluorocarbons (HFCs) are refrigerants that were introduced to replace ozone-depleting refrigerants such as chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs) under the Montreal Protocol. However, HFCs are potent greenhouse gases with a 100-year Global Warming Potential ranging up to 14,800 times higher than carbon dioxide. As a result, there is now a gradual phaseout of HFCs mandated under the Kigali Amendment to the Montreal Protocol, which came into force in 2019.

Emissions from local HFC use are not included in emissions inventories at the community scale as per the Federation of Canadian Municipalities' Partners for Climate Protection Program.

Canadian HFC use data is derived from bulk imports, and imports and exports of manufactured items such as refrigerators and air conditioners.

Surveys were performed by Environment Canada in 2012 to document practices in HFC use and disposal and to support the development of country-specific emission factors that are representative of Canada's circumstances for use in Canada's National Inventory Report.

Using the HFC emissions data for Ontario from Canada's National Inventory Report, the average per capita emissions from HFC use was estimated to be around 0.29 tonnes of equivalent carbon dioxide per person in 2021. This is lower than it was back in 2019, when it was estimated to be around 0.32 tonnes of equivalent carbon dioxide per person. Applying this to London's population works out to approximately 122,000 tonnes per year of equivalent carbon dioxide.

9. Summary and Conclusions

9.1 Energy Use

The impact of the COVID-19 pandemic on transportation energy use in 2022 remained significant, which was 12 per cent lower overall compared to 2019. In particular:

- The local retail sales of gasoline and diesel at gas stations was 15% lower than 2019 because of many London workplaces shifting to work from home as well as reduced discretionary trips associated with stay-at-home orders and similar restrictions.
- The estimated total distance of trips taken by bike in London were 27% longer in 2021 (latest data available) compared to 2019.
- The number of vehicles registered for every 1,000 people in London in 2022 was still 13% lower than in 2019.

It is anticipated that the shift to working-from-home will remain in place at London's workplaces after the COVID-19 pandemic is over, although this is not likely to be a full-time shift for everybody. It is also anticipated that the interest in cycling for transportation will continue to grow.

Residential (single-family home) energy efficiency has seen improvement, driven by energy conservation programs such as the former federal and provincial home energy audit and retrofit programs, along with utility conservation and demand management programs. New home construction in London has seen energy efficiency improvements driven by voluntary participation in efficiency programs such as Energy Star New Homes, as well as the 2012 Ontario Building Code.

Over the last ten years, energy efficiency for London's industrial, commercial, and institutional sector has been improving. London has many examples of local employers who have acted on energy efficiency and conservation.

In summary, specific highlights of recent community energy use progress and longer-term trends, include:

- Londoners are using energy more efficiently – on a per person basis, Londoners and London businesses used 20% less energy overall in 2022 than used in 2005.
- London is producing more goods and services for every unit of energy used – on a dollar gross domestic product (GDP adjusted for inflation) per unit energy basis, London's industrial, commercial, and institutional sector improved the value of goods and services produced per unit of energy used by 58% between 1990 and 2022.

- $1.85 billion was spent by Londoners and London businesses on energy in 2022, higher than in recent years due to higher global energy prices. About 85% of this money left London.

- London is spending less money on energy – improvements in energy efficiency compared to 2010 levels of efficiency (on a per person basis and applied to activity in 2022) avoided about $510 million in energy costs had there been no improvements.

- The number of “green” vehicles in London (i.e., hybrids and electric vehicles) is about nine times higher than it was in 2010. There are now over 2,000 electric vehicles registered in London. However, the number of “gas guzzling” SUVs and pick-up trucks in London has also increased.

9.2 Greenhouse Gas Emissions

From a greenhouse gas emissions reduction perspective, credit should be given to the previous Government of Ontario for following through on its plans to replace coal-fired power generation plants with cleaner sources, such as nuclear, hydroelectric, natural gas, and renewables, as well as encouraging electricity conservation. Since 2005, there has been a downward trend driven by a combination of cleaner electricity generation and improved energy efficiency.

The reductions in energy use noted above are also a contributor to London’s significant reductions in greenhouse gas emissions. Federal vehicle emission standards and provincial ethanol in gasoline requirements have also helped to reduce transportation greenhouse gas emissions. Finally, the City of London’s landfill gas collection and flaring system represents the largest source of greenhouse gas emissions reduction directly under municipal government control.

However, the cancellation of provincial renewable electricity contracts and electric vehicle incentives may have contributed to the loss of momentum. As noted earlier, London’s emissions in 2022 would have been 45,000 tonnes lower had the emissions intensity of Ontario’s electricity grid remained unchanged. For 2022 electric vehicle sales, as of the third quarter of 2022, Ontario’s EV market share of 6.0 per cent was below the national average of 7.7 per cent and far behind British Columbia and Quebec at 15.6 per cent and 11.8 per cent respectively. London’s EV market share is even lower, at 3.2 percent in 2022, due to the low availability of EVs in smaller markets like London.

In summary: the use of energy in London has had the following greenhouse gas impacts:

- Total GHG emissions in 2022 were 2.96 million tonnes of equivalent carbon dioxide – the top three sources were personal vehicles (27%), low- and medium-density housing (19%), and local industry (16%).

- London's total GHG emissions in 2022 were 24% below 2005 levels – higher than the previous year due to the impact of colder winter weather compared to the previous year.

- Londoners' per-person GHG emissions are significantly lower – on a per person basis, Londoners and London businesses released 39% fewer GHG emissions in 2022 than they did in 2005.

In terms of household GHG emissions, the average household emitted 9.2 tonnes per year. Almost half (43%) of this came from burning gasoline. Natural gas used for space heating and water heating accounted also accounted for 43 per cent of emissions. Organic waste in the landfill accounted for about seven per cent. Given Ontario's relatively clean electricity grid, using electricity in the home accounted for four per cent of household GHG emissions.

Whether emissions continue to decrease depends upon the impact of energy and fuel conservation efforts, provincial and federal climate change policies, climate trends, economic growth, and consumer choices. It is also important to note that these actions also contribute to reductions in air pollution emissions (e.g., nitrogen oxides, volatile organic compounds) from fossil fuel use.

The quantification of GHG emissions from the consumption of goods and services used by Londoners and London's employers is a growing area of interest for the City of London and has been included as an action within London's Climate Emergency Action Plan. Almost all these GHG emissions occur outside London. For consumer goods, most of these emissions occur outside of Canada. However, Londoners and London's employers can influence these emissions by the choices made regarding the goods and services they use.

Appendix A - Methodology

This document builds upon two foundational energy use and GHG emissions inventories that have been developed for London and related data, specifically:

- The 1995 *City of London Air Emissions Study*, prepared by SENES Consultants in association with Proctor & Redfern Limited and Torrie Smith Associates. It provided the baseline inventory for the community (1990) and municipal operations (1992).

- The London Energy/Air Emissions Reduction Strategy Task Force report in March 2000 titled *Air Emissions and Energy Use in the City of London.* This report revised the baseline 1990 community inventory and provided an update to the community inventory using 1998 data. It also provided an emissions and energy use business-as-usual forecast for 2001, 2006, 2012, and 2016.

Since 2003, City of London (Environmental Programs) staff has maintained and updated the community energy use and GHG emissions inventory on an annual basis.

The methodology employed is consistent with the GHG emission inventory protocol provided by ICLEI Canada for participants in the Federation of Canadian Municipalities' Partners for Climate Protection (PCP) program. The *2012 Community Energy & Greenhouse Gas Inventory: Challenges & Opportunities* report was reviewed by ICLEI and FCM staff as part of the City of London's Milestone 5 recognition for the PCP program.

The GHG inventory includes Scope 1 and Scope 2 emission sources, plus those Scope 3 emission sources required by the Global Covenant of Mayors:

- Scope 1 - GHG emissions from fuel use and landfills within the boundary of the city
- Scope 2 - Indirect GHG emissions that occur outside of the city boundary because of electricity consumption within the city
- Scope 3 - Other indirect emissions that occur outside of the city boundary because of activity within the city:
    - solid waste disposal (IC&I waste disposed in landfills outside London)
    - domestic aviation
    - railways

The remaining Scope 3 emissions, other indirect emissions and embodied emissions that occur outside of the city boundary because of activities of the city, are not included in the inventory, such as:

- marine transportation of goods
- embodied emissions upstream of power plants
- embodied emissions in fuels
- embodied emissions in imported construction materials
- embodied emissions in imported goods
- embodied emissions in imported food

A.1. Community Inventory Data Collection

Data for the community inventory is available for 1990, 1998, 2002, and 2004-2022 unless otherwise noted below. The inventory information used for the residential sector is based on the following:

- Annual electricity use data was provided by London Hydro. Note that this excludes multi-unit residential buildings, which are considered to be commercial accounts by London Hydro.

- Annual natural gas use data was provided by Enbridge Gas. Note that this excludes multi-unit residential buildings, which are considered to be commercial accounts by Union Gas.

- Other home heating fuel data (e.g., propane, fuel oil) was obtained from Statistics Canada end-use energy data for Ontario prorated by population to estimate use within London. Note that the latest information is from 2021.

The inventory information used for the business and institutional sector is based on the following:

- Annual electricity use was provided by London Hydro. Note that this includes General Service < 50 kW , General Service > 50 kW , Large Users > 5000 kW, Users with Embedded Services (e.g., co-generation plants), sentinel lights, and street lighting.

- Annual natural gas use was provided by Enbridge Gas. Note that this includes industrial, commercial, and institutional accounts.

- Other fuel data (e.g., fuel oil, kerosene) developed from Statistics Canada end-use data for Ontario prorated by population to estimate use within London. Note that the latest information is from 2021.

The inventory information used for the transportation sector is based on the following:

- Annual retail transportation fuel sales data for gasoline, ethanol-blended gasoline (E10) and diesel was provided by Kalibrate Canada. Given that London is a self-contained urban area, it is assumed that all transportation fuel used by London residents and businesses are purchased within London. This information has the benefit of being current (2022 data).

- Diesel use for public transit was provided by London Transit.

- Diesel use for road freight transportation was estimated using national-level 2021 data from Statistics Canada, prorated by population, to provide estimates that reflected the impact of the COVID-19 pandemic on road freight transportation.

- Diesel used for railways was developed from Statistics Canada energy end-use data for Ontario prorated by population to estimate use within London. Note that the latest information is from 2021.

- Community non-retail (i.e., commercial and other institutional) transportation fuel data developed from Statistics Canada end-use energy data for Ontario prorated by population to estimate use within London. Propane identified as being used in the commercial and industrial sector is assumed to be used as transportation fuel only. Note that the latest information is from 2021.

- Aviation fuel use was estimated using Ontario-level domestic aviation emissions data from *Canada's National Inventory Report 1990-2021,* prorated by population. Note that the latest information is from 2021.

The inventory information used for landfills is based on the following:

- Annual waste quantities placed within the landfills for each calendar year. Note that in 2022, City staff reviewed and revised the waste quantity values used within the Scholl Canyon model used by City staff for estimating methane generation in the landfill.

- For the W12A landfill, the emission reductions associated with the landfill gas collection and flaring system are based on continuously measured landfill gas flow rate and methane concentration at the landfill flare.

- The global warming potential (GWP) of methane of 25, as per the Intergovernmental Panel on Climate Change's *Fourth Assessment Report* and used by the federal government in recent GHG emissions reporting. Note that the City of London will apply the methane GWP of 28 from the *Fifth Assessment Report* in next year's 2023 Community Energy Use and Greenhouse Gas Emissions Inventory, in line with the federal government's GHG emissions report submissions for 2022 data underway in 2023.

The inventory information used for waste generated in London and disposed outside of London is based on the following:

- GHG emissions were estimated by taking the reported GHG emissions from the Twin Creek Landfill and Ridge Landfill for 2016 and dividing it by London's share of the annual fill rate at these landfills. City of London Solid Waste Management staff estimated the volume of London's industrial, commercial, and institutional (IC&I) sector solid waste disposed outside of London to be around 83,000 tonnes – 45,000 tonnes to the Twin Creek Landfill and 8,000 tonnes to landfills in Michigan.

- For the 1990 to 2016 period, the amount of IC&I waste per capita was assumed to be the same as reported last year, namely 0.31 tonnes per person. GHG emissions were estimated based on the Ontario Waste Management Association' Cap & Trade Research spreadsheet model for Ontario waste sector; based on the model's estimated 0.75 tonnes CO_2e emitted per tonne waste disposed at large landfills. It was assumed 50% landfill gas capture from 2002 to 2022, only 25% landfill gas capture for 1998, and no landfill gas capture for 1990.

As a result of London having joined the Global Covenant of Mayors in 2015, it is recommended that nitrous oxide emissions from sewage treatment be included within London's energy and GHG emissions inventory as per the Global Protocol for Community-Scale GHG Emissions Inventories (GPC). Nitrous oxide is a combustion by-product from the incineration of sewage sludge and its formation is influenced by incinerator operating conditions (i.e., combustion temperature).

Since 2008, annual stack testing at the Greenway Wastewater Treatment Plant sludge incinerator has included the measurement to nitrous oxide alongside other air pollutants. Table A-1 summarizes the nitrous oxide stack test results.

As can be seen from the table above, measured emissions of nitrous oxides can vary from year to year.

Table A-1: Summary of 2008 – 2022 Stack Test Results for Nitrous Oxide (N_2O) Emissions from the Greenway WWTP Sewage Sludge Incinerator

Year	Measured average emissions g/s	Measured average emissions kg/hour	Estimated annual emissions tonnes/year	Estimated annual CO_2e tonnes/year
2008	0.1	0.4	3	1,000
2009	1.1	3.9	28	8,800
2010	1.1	3.9	28	8,700
2011	1.2	4.4	32	9,900
2012	1.0	3.5	26	7,900
2013	0.2	0.6	4	1,400
2014	1.1	4.1	29	9,100
2015	1.0	3.7	26	8,200
2016	0.3	1.1	7	2,300
2017	2.4	8.6	65	20,000
2018	1.7	6.0	43	13,000
2019	1.5	5.5	33	10,200
2020	0.8	3.0	18	5,500
2021	0.5	1.6	9	2,800
2022	1.2	4.4	26	8,100

A.2. Greenhouse Gas Emission Factors for Energy Commodities

Greenhouse gas emissions associated with energy use were calculated based on the emission factors provided by *Canada's National Inventory Report 1990-2021*, except for the 2022 grid-average emission factors for Ontario, which have been estimated based on the 2022 system-wide electricity supply mix for Ontario reported by the Ontario Energy Board, combined with the data from *Canada's National Inventory Report 1990-2021*. A summary of emission factors has been provided in Table A-2.

All GHG emissions are expressed in terms of equivalent carbon dioxide (CO_2e), based on the global warming potentials (GWP) of the various GHG emissions provided by *Canada's National Inventory Report 1990-2021.*

Table A-2 – Greenhouse Gas Emission Factors and Energy Conversions

Source of Emission	Emission Factor (CO_2e)	Information Source
Electricity - Ontario 2022	0.043 kg/kWh	Estimated based on OEB information for 2022
Electricity - Ontario 2021	0.030 kg/kWh	National Inventory Report, 1990-2021 - ANNEX 11
Electricity - Ontario 2020	0.028 kg/kWh	National Inventory Report, 1990-2021 - ANNEX 11
Electricity - Ontario 2019	0.029 kg/kWh	National Inventory Report, 1990-2021 - ANNEX 11
Electricity - Ontario 2018	0.030 kg/kWh	National Inventory Report, 1990-2021 - ANNEX 11
Electricity - Ontario 2017	0.020 kg/kWh	National Inventory Report, 1990-2021 - ANNEX 11
Electricity - Ontario 2016	0.041 kg/kWh	National Inventory Report, 1990-2021 - ANNEX 11
Electricity - Ontario 2015	0.043 kg/kWh	National Inventory Report, 1990-2021 - ANNEX 11
Electricity - Ontario 2014	0.042 kg/kWh	National Inventory Report, 1990-2021 - ANNEX 11
Electricity - Ontario 2013	0.077 kg/kWh	National Inventory Report, 1990-2021 - ANNEX 11
Electricity - Ontario 2012	0.110 kg/kWh	National Inventory Report, 1990-2021 - ANNEX 11
Electricity - Ontario 2011	0.110 kg/kWh	National Inventory Report, 1990-2021 - ANNEX 11
Electricity - Ontario 2010	0.140 kg/kWh	National Inventory Report, 1990-2021 - ANNEX 11
Electricity - Ontario 2009	0.120 kg/kWh	National Inventory Report, 1990-2021 - ANNEX 11
Electricity - Ontario 2008	0.170 kg/kWh	National Inventory Report, 1990-2021 - ANNEX 11
Electricity - Ontario 2007	0.240 kg/kWh	National Inventory Report, 1990-2021 - ANNEX 11
Electricity - Ontario 2006	0.210 kg/kWh	National Inventory Report, 1990-2021 - ANNEX 11
Electricity - Ontario 2005	0.250 kg/kWh	National Inventory Report, 1990-2021 - ANNEX 11
Electricity - Ontario 2004	0.220 kg/kWh	National Inventory Report, 1990-2021 - ANNEX 11
Electricity - Ontario 2003	0.300 kg/kWh	National Inventory Report, 1990-2021 - ANNEX 11
Electricity - Ontario 2002	0.290 kg/kWh	National Inventory Report, 1990-2021 - ANNEX 11
natural gas	1.90 kg/m^3	National Inventory Report, 1990-2021 - ANNEX 11
fuel oil	2.76 kg/L	National Inventory Report, 1990-2021 - ANNEX 11
propane	1.55 kg/L	National Inventory Report, 1990-2021 - ANNEX 11
gasoline	2.30 kg/L	National Inventory Report, 1990-2021 - ANNEX 11
diesel	2.71 kg/L	National Inventory Report, 1990-2021 - ANNEX 11
gasoline (E-10)	2.07 kg/L	National Inventory Report, 1990-2021 - ANNEX 11

A.3. Cost Estimates for Community Energy Use

Information on the cost of using petroleum products is based on information available from Kalibrate Canada, specifically:

- Annual retail prices (including tax) and wholesale prices for regular-grade gasoline, mid-grade gasoline, premium-grade gasoline, diesel, and furnace oil;
- Crude oil price component associated with retail fuels, allocated to Western Canada (Alberta and Saskatchewan) which is the source of oil for refineries in Sarnia;
- The refiners operating margin, which is the difference between annual crude oil prices and wholesale prices, allocated to Ontario (refineries in Sarnia);
- The Harmonized (Federal and Provincial) Sales Tax and Federal Fuel Excise Tax; and
- The marketing operating margin, which is the difference between annual retail prices the wholesale prices and federal and provincial taxes, allocated to London (gas stations).

This allocation method was reviewed and accepted as being reasonable in 2013 by Kent Marketing (now Kalibrate Canada).

Information on the cost of using electricity is based on customer rate structure information available on London Hydro's website, specifically:

- The Rate Component ($/kWh), the Loss Adjustment Factor, and (where applicable) the Global Adjustment, which is allocated to Ontario reflect the cost to generate electricity in Ontario;
- Delivery-related costs (Distribution Variable Charge, Network Charge, Connection Charge, Rate Rider for Tax Change, and Rate Rider for Variance Account), which is allocated to London to reflect London Hydro's operations;
- Transmission-related costs, which is allocated to Ontario to reflect Hydro One's operations; and
- Regulatory-related and Government-related charges (e.g., Ontario Hydro Debt Retirement, HST).

This allocation method was reviewed and accepted as being reasonable in 2013 by Wattsworth Analysis, the City of London's energy procurement advisor.
Information on the cost of using natural gas is based on customer rate structure information available on Enbridge Gas's website, specifically:

- The Gas Commodity Rate, the Gas Price Adjustment, and Transportation, which is allocated to a mix of Western Canada (conventional gas wells) and United States (shale gas) to reflect the sources of natural gas supply and transporting this gas to Ontario;

- Storage-related costs, which is allocated to Ontario to reflect Enbridge Gas's regional and Ontario-wide storage and distribution operations;
- Delivery-related costs, which is allocated to London to reflect Enbridge Gas's local operations to supply natural gas to customers in London; and
- The HST.

This allocation method was reviewed and accepted as being reasonable by Wattsworth Analysis.

Appendix B - 2003-2019 Heating & Cooling Degree Days for London

A heating degree day (HDD) is a measurement tool used to estimate energy demand needed to heat a home or business. A similar measurement, a cooling degree day (CDD), reflects the amount of energy used to cool a home or business.

It is based on the average outdoor air temperature over an entire day. The heating needs for a home or a building are generally directly proportional to the number of HDD at that location. Heating degree days are defined relative to a base temperature; the outside temperature above which a building needs no heating. For homes, a daily average temperature of 18 °C is used as this base. Therefore, if the average temperature for a day was 8 °C, then the HDD would be 10 for that day. Similarly, if the average temperature for a day was -2 °C, then the HDD would be 20 for that day. A typical winter month would have about 700 HDDs in London.

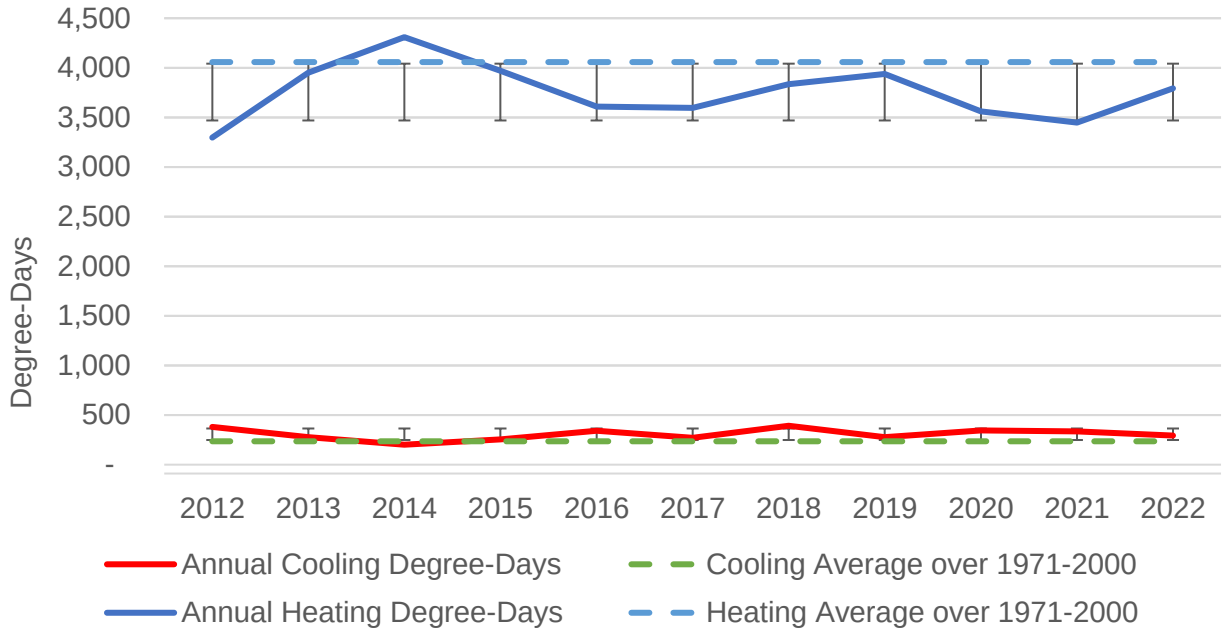
Environment Canada produces Climate Normal data ranges over a historic 30-year period. Over the last 10 years, most winters and summers have been warmer than they were over the 1971-2000 period.

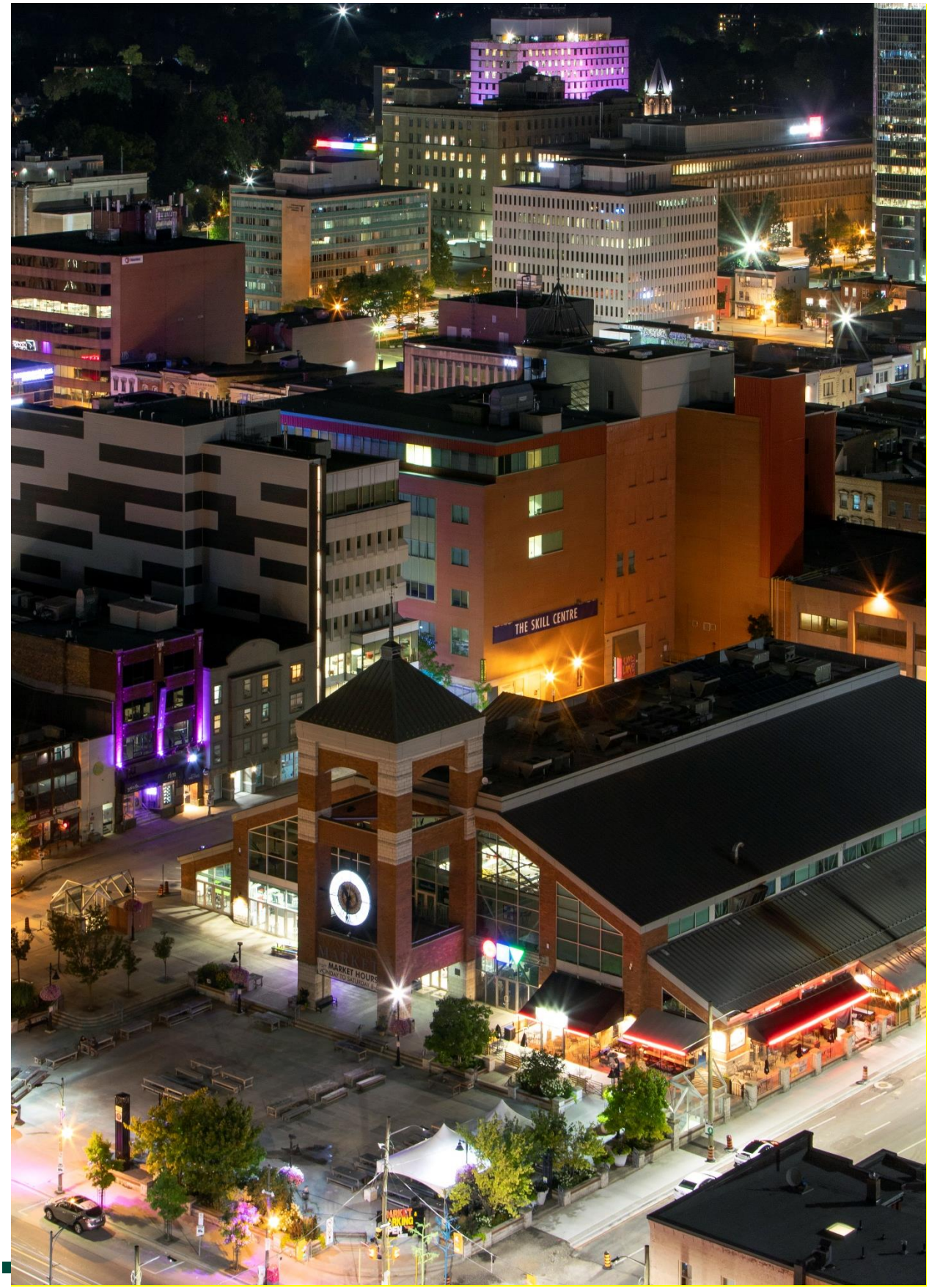
Table B-1 – Annual Residential Heating and Cooling Degree-Days for London

Year	Heating Degree-Days	Cooling Degree-Days	Heating - Difference from 30 Year Average	Cooling - Difference from 30 Year Average
2012	3,297	381	-19%	62%
2013	3,951	276	-3%	17%
2014	4,309	201	6%	-15%
2015	3,971	254	-2%	-8%
2016	3,615	343	-11%	46%
2017	3,597	271	-11%	15%
2018	3,836	392	-5%	66%
2019	3,937	277	-3%	17%
2020	3,562	347	-12%	47%
2021	3,449	336	-15%	42%
2022	3,793	295	-7%	25%
Average	*3,756*	*307*	*-7%*	*30%*
Climate Normal (1971-2000)	**4,058**	**236**		

Using this data, it can be assumed that, over the last 10 years, building heating needs were about seven per cent lower than they would have been back in the 1971-2000 period, and that air conditioning needs were 30 per cent higher.

Figure B-1 – Annual Residential Heating and Cooling Degree-Days for London




THE SKILL CENTRE

Consumption-based Greenhouse Gas (GHG) Emissions City of London

Corporate Knights

February 23, 2023

Sector-based GHG Inventories are the most common and include:

Scope 1: emissions from energy use within the city through direct combustion

Scope 2: emissions produced from grid-supplied electricity, heating and/or cooling

Scope 3: emissions produced outside of the city as a result of city activities

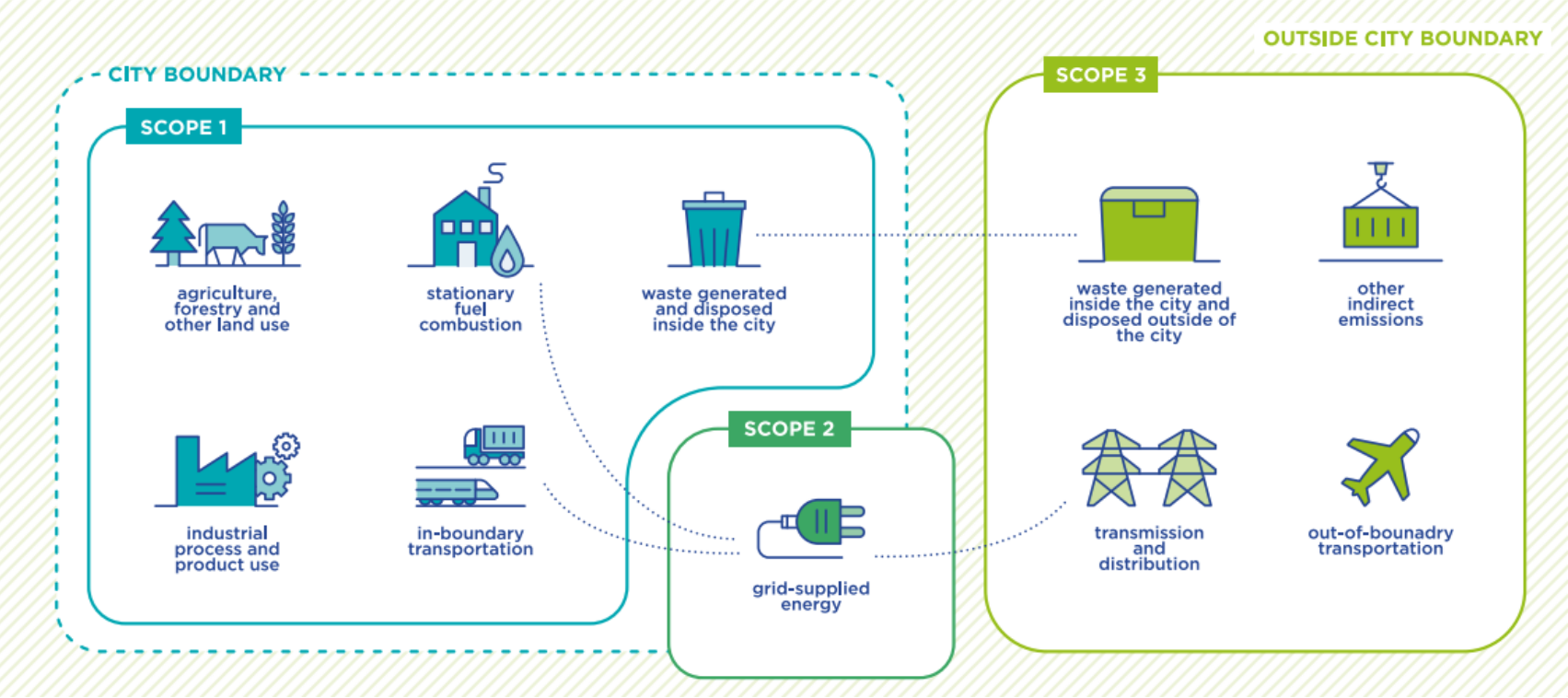


Figure 1 from *Consumption-Based GHG Emissions of C40 Cities*

The consumption-based inventory includes the emissions embedded in the goods and services consumed in the city.

Consumption-based inventory

The direct emissions of households and personal transportation in the city, plus the emissions embedded in the goods and services consumed within the city, regardless of where the goods and services are produced.

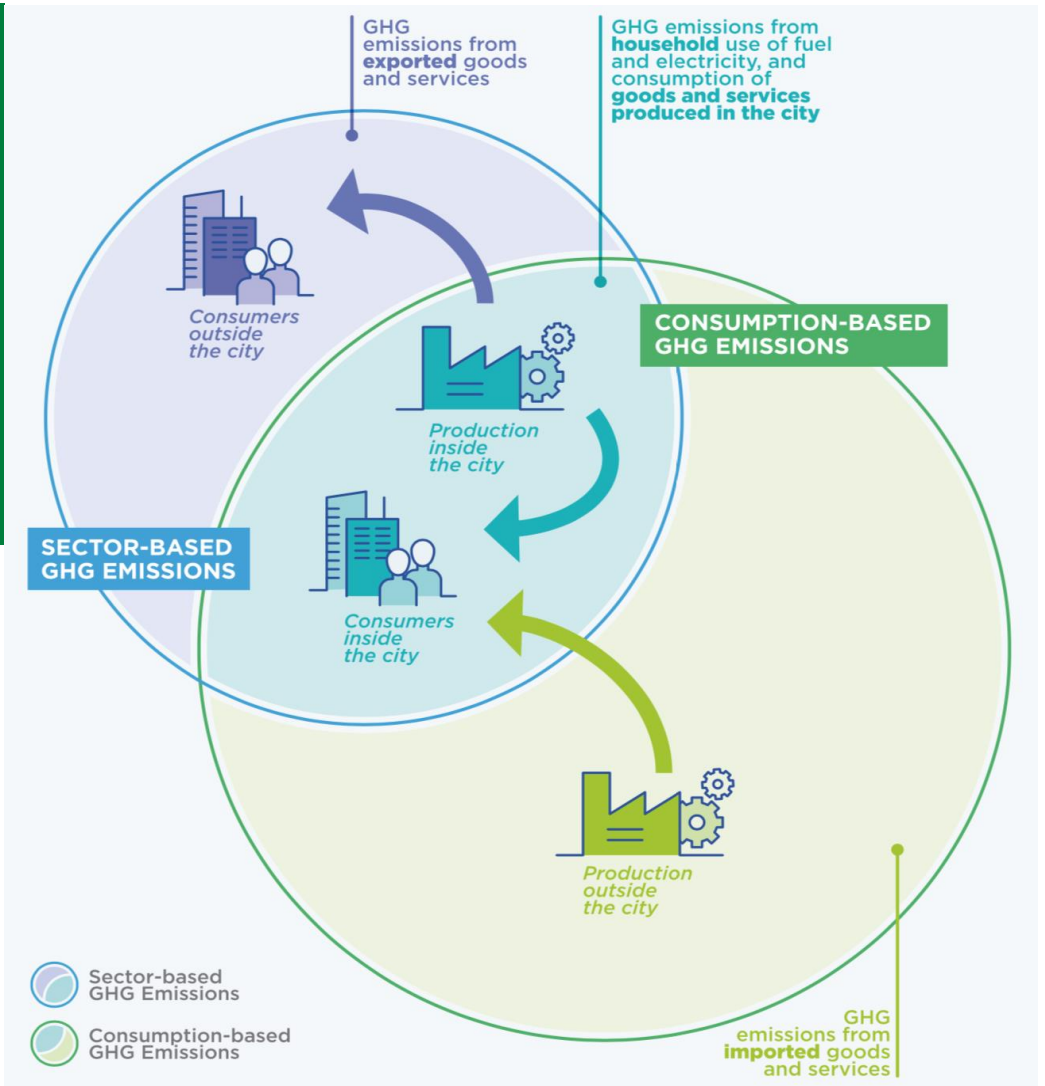


Figure 2 from *Consumption-Based GHG Emissions of C40 Cities*

Consumption-based Emissions Methodology

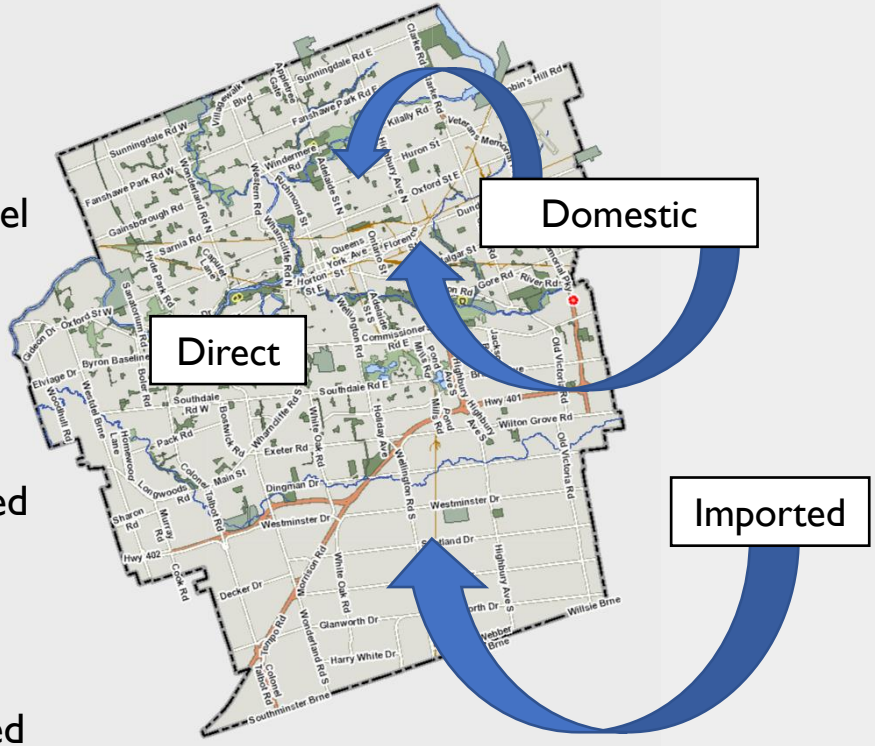
Consumption-based emissions are broken down into 3 parts:

Part 1 ("Direct"): Emissions from city's residential fuel and electricity use*, personal transportation fuel, and residential waste

**based on provincial grid electricity GHG intensity*

Part 2 ("Domestic"): Emissions embedded in goods and services that are consumed in the city and produced by the domestic economy (including the city's contribution to the domestic economy)

Part 3 ("Imported"): Emissions embedded in goods and services that are consumed in the city and imported from other countries



Emissions from the production of goods in London are only included in the consumption-based inventory to the extent the products (or services) are consumed within London.

In sector-based inventories, emissions generated from London's food and beverage industry would count toward City of London's GHG inventory (Scope 1).

In the consumption-based inventory method, emissions generated from London's food and beverage industry are allocated to the domestic economy, and the City of London's share of those emissions is prorated to the City of London's share of the domestic economy.

Emissions from services produced and consumed locally are included in the consumption-based inventory

Many services are produced and consumed locally, within the city's boundaries.

In both sector- and consumption-based emissions inventories, emissions produced from local services such as banks, schools, house cleaning, legal support, etc. count toward the city's GHG inventory.

Schools

Banks

House Cleaning

Legal support

London's consumption-based GHG "footprint" is more than three times its sector-based inventory

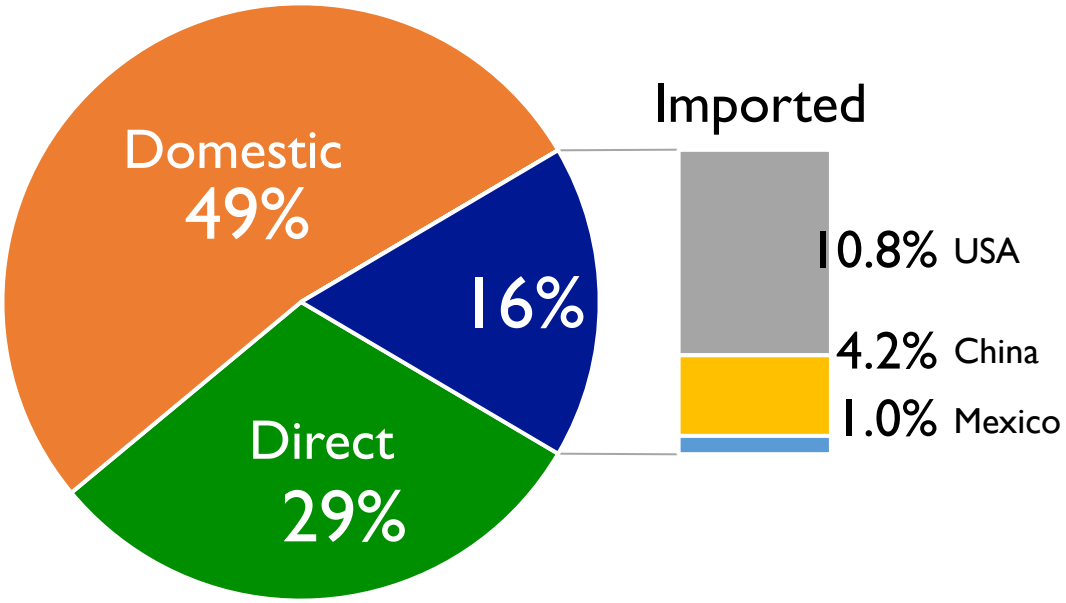
Sector-based Emissions reported in tonnes CO_2e	
Scope 1	2,957,000
Scope 2	98,000
Scope 3	17,000
Total	3,072,000
Inventory Year	2019
Population in Inventory Year	410,000
GHG Emissions per capita	7.5

As per 2019 GPC Reporting Tool for City of London

Consumption-based Emissions reported in tonnes CO_2e	
Part 1: Direct emissions of household energy use and waste, personal transportation	2,750,000
Part 2: Embedded in goods produced in domestic economy	4,740,000
Part 3: Embedded in imported goods	2,106,000
Total	9,595,000
Analysis Year	2019
Population in Analysis Year	410,000
GHG Emissions per capita	23.4

As per Corporate Knights analysis for 2019

Consumption-based Emissions Breakdown (2019)

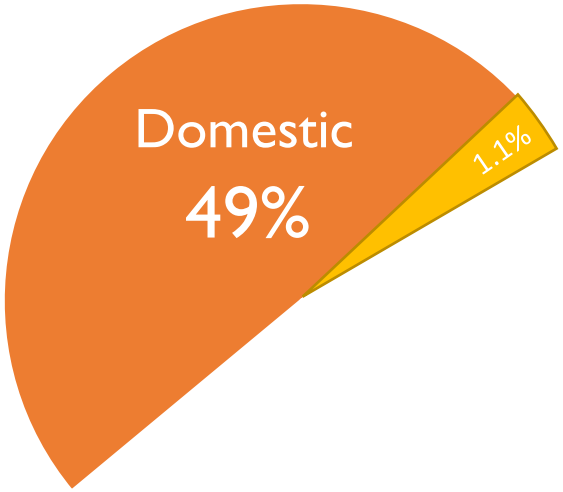


Direct (29%): emissions produced by City of London residents from daily activities such as residential electricity use, fuel use for residential buildings (ex. heating & cooling), personal transportation, and residential waste

Domestic (49%): emissions from goods produced in city and in Canada, and consumed within the City of London

Imported (16%): emissions from goods that were produced in USA (10.8%), China (4.2%), Mexico (1.0%), and other countries that are consumed within the City of London

Domestic Consumption-based Emissions



Domestic Emissions:

It is estimated that London's GDP is approximately 1.1% of Canada's GDP.

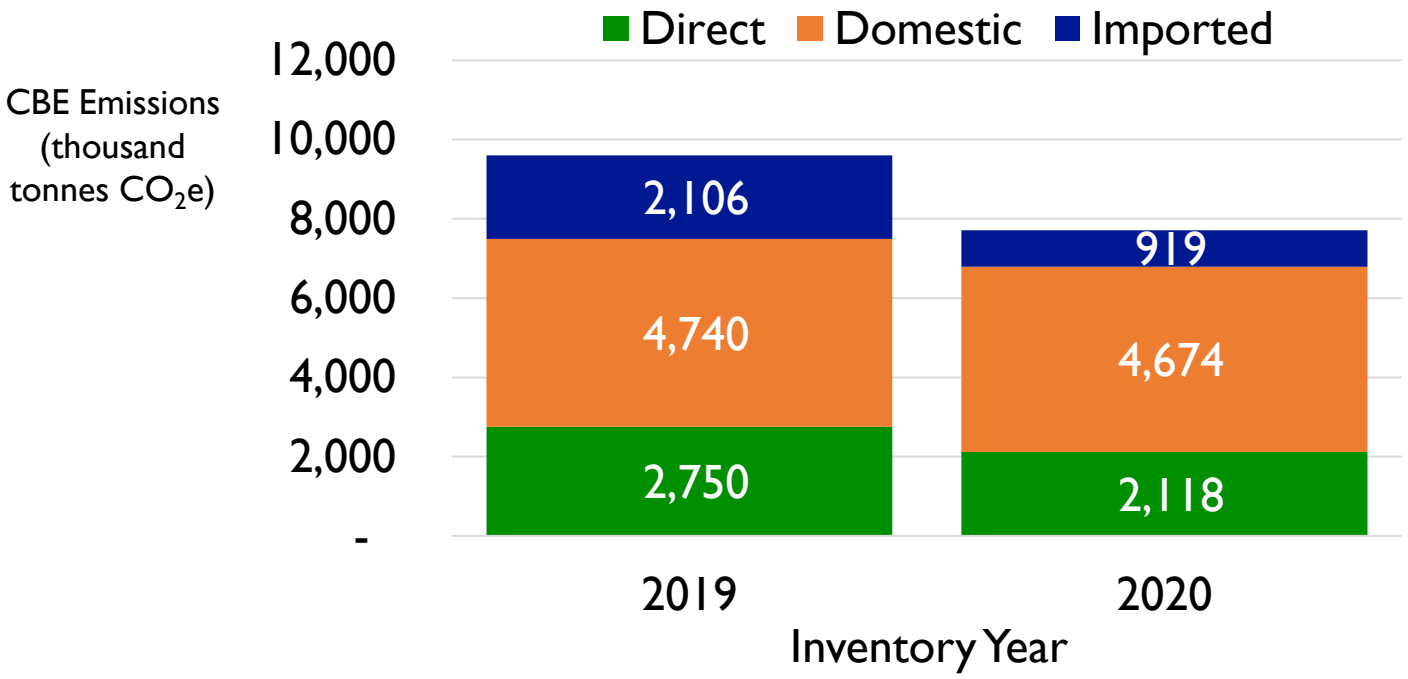
Therefore, it is likely that 1.1% of GHG emissions of the "Domestic" portion are produced within the city of London.

The remainder of "Domestic" emissions consumed in London are embedded in goods and services produced in Canada.

A comparison of 2019 and 2020 consumption-based inventories shows significant declines in the emissions embedded in imports and in household-based emissions

International trade decreased in 2020 as a result of the COVID-19 pandemic.

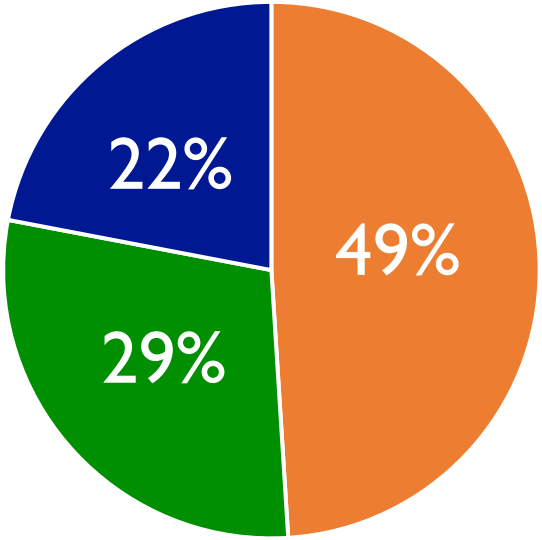
In 2019, the City of London consumed 2x more international goods than during 2020.



The City of London consumption-based GHG footprint is similar to other Canadian cities.

Roughly 25% from household energy use and waste, 50% from emissions embedded in domestically produced goods and services (including production in the City of London, and 25% from emissions embedded in goods imported from abroad.

City of London



Average of Canadian cities

Calgary
Edmonton
Halifax
Montreal
Ottawa
Toronto
Vancouver

Appendix

2020: London's consumption-based GHG "footprint" is nearly three times its sector-based inventory

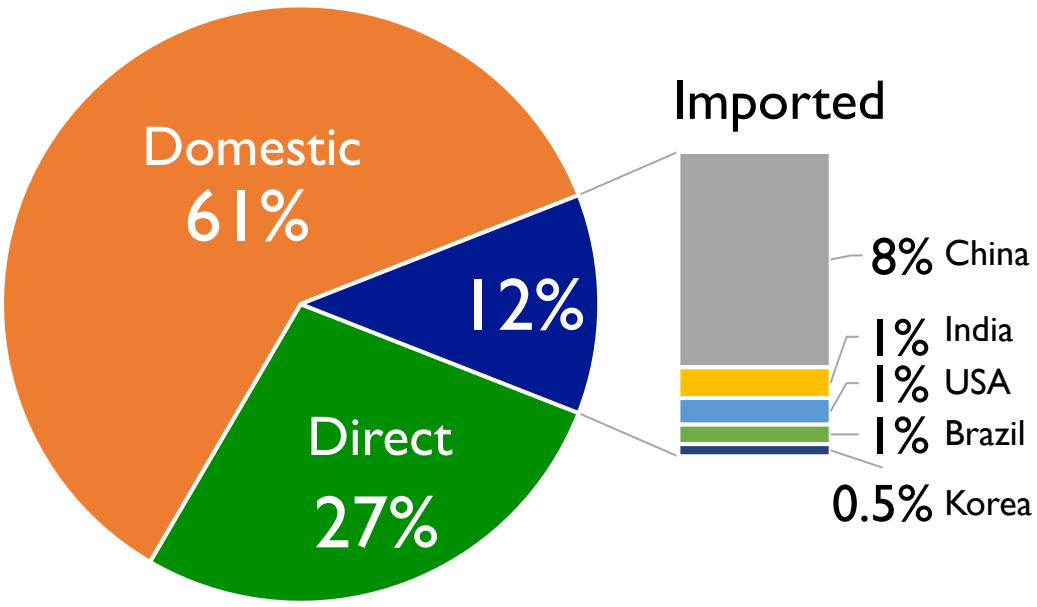
Sector-based	Emissions reported in tonnes CO_2e
Scope 1	2,515,000
Scope 2	133,000
Scope 3	17,000
Total	2,665,000
Inventory Year	2020
Population in Inventory Year	417,000
GHG Emissions per capita	6.4

As per CDP Cities 2022 city-wide emissions

Consumption-based	Emissions reported in tonnes CO_2e
Part 1: Direct emissions of household energy use and waste, personal transportation	2,118,000
Part 2: Embedded in goods produced in domestic economy	4,674,000
Part 3: Embedded in imported goods	919,000
Total	7,711,000
Analysis Year	2020
Population in Analysis Year	417,000
GHG Emissions per capita	18.5

As per Corporate Knights analysis for 2020

Consumption-based Emissions Breakdown (2020)



Direct (27%): emissions produced by City of London residents from daily activities such as residential electricity use, fuel use for residential buildings (ex. heating & cooling), personal transportation, and residential waste

Domestic (61%): emissions from goods produced in city and Canada, and consumed within the City of London

Imported (12%): emissions from goods that were produced in China (8%), India (1%), USA (1%), Brazil (1%), and South Korea (0.5%), and other countries that are consumed within the City of London

Comparison of household emissions in London's 2020 sector-based inventory with the Part 1 "direct" emissions component of the consumption-based inventory:

2020 Community Energy Use & Greenhouse Gas Emissions Inventory

Household Activity
Gasoline use (vehicles)
Natural gas use
Home heating
Hot water heating
Electricity use
Air conditioning
Appliance & plug load
Lighting
HVAC fan motor
Propane use
Food waste in garbage

Table 18 – Estimated Average Household Energy Use and Emissions in London for 2020	
Average emissions per household	9.3
Average household size	2.4*
Total household emissions	1,615,875
Population in Inventory Year	417,000
GHG Emissions per capita	**3.9**

GHG Emissions in tonnes CO_2e
*estimated from 2016 census of Metro London

"Direct" household-based emissions in Corporate Knights' consumption-based inventory for 2020:

Emissions from city's residential fuel and electricity use, personal transportation fuel, and waste	
Part 1: Direct	2,118,000
Population in Analysis Year	417,000
GHG Emissions per capita	**5.0**

Emissions reported in tonnes CO_2e

London's Consumption-Relation GHG Emissions vs Corporate Knights Consumption-based Inventory

2020 Community Energy Use & Greenhouse Gas Emissions Inventory

Table 19 – Estimated Average Household Consumption-Relation GHG Emissions in London

Household activity or purchases	Average Annual Lifecycle GHG Emissions (tonnes CO_2e per household)
Air travel – domestic	0.4
Air travel – international	2.7
Food – beef (e.g., enteric fermentation, processing, transportation)	1.1
Food – other (e.g., fertilizer, farm fuel use, processing, transportation)	2.0
Home – raw material extraction & processing, home construction	0.7
Home – natural gas extraction & processing, pipeline transportation	1.2
Other purchased goods & services (e.g., clothing, electronics, internet)	7.0
Vehicle – raw material extraction & processing, parts manufacturing & assembly	1.6
Vehicle fuel – oil extraction, fuel refining, pipeline transportation	1.0
Total Consumption (Scope 3) Emissions	**17.7**

Part 1	
Average emissions per household	17.7
Average household size	2.4*
Total household emissions	3,075,375
Population in Inventory Year	417,000
GHG Emissions per capita	7.4

Average Annual GHG Emissions (tonnes CO_2e)
*estimated from 2016 census of Metro London

Part 2 & 3	
Part 2: Domestic	4,674,000
Part 3: Imported	919,000
Total	5,593,000
GHG Emissions per capita	13.4

Emissions reported in tonnes CO_2e

Detailed Methodology

From 2022 Sustainable Cities Index Methodology https://www.corporateknights.com/wp-content/uploads/2022/06/2022-Sustainable-Cities-Methodology.pdf

The calculation of detailed and precise consumption-based inventories is complex, but they can be estimated with simple methods, which is the approach we have taken.

1 | We begin with the country's sector-based inventory, using the Emissions Database for Global Atmospheric Research (EDGAR) and partition it into two parts: the emissions associated with the final consumption of the household sector, which we call the final consumption emissions, and the emissions that are used to generate the country's GDP, which we call the productive economy emissions.

2 | Emissions associated with final consumption in the household sector are estimated as the sum of three components:

a. The EDGAR residential sector emissions from fuel combustion, plus 50% of the waste sector emissions in the EDGAR inventory
b. the EDGAR power sector emissions multiplied by the portion of national electricity consumption in the residential sector, according to the IEA World Energy Balances, and
c. the EDGAR transportation sector emissions multiplied by the portion of transportation energy used for personal transportation, according to the IEA Energy Efficiency data product

This sum is then divided by the country population to get per capita final consumption emissions. This is multiplied by city population to estimate the final consumption emissions for the city.

(…continued next slide)

Detailed Methodology (cont.)

From 2022 Sustainable Cities Index Methodology https://www.corporateknights.com/wp-content/uploads/2022/06/2022-Sustainable-Cities-Methodology.pdf

3 | After subtracting the emissions from final consumption in the household sector from the EDGAR inventory to get the emissions of the productive economy, we divide the country's productive economy emissions into the portion associated with domestic consumption and the portion that is exported. We do this by multiplying the country's productive economy emissions by the percent of the country's GDP that is exported, according to the World Bank trade statistics. This involves the simplifying assumption that the portion of a country's productive economy emissions that is exported can be equated with the portion of a country's GDP that is exported. The emissions related to domestic consumption of the output of the productive economy are divided by population to get a per capita value for emissions embedded in domestic consumption, and this is multiplied by city population to assign a share of the productive economy emissions to the city.

4 | Two of these three components of the country's emissions inventory – the final consumption emissions and the portion of the productive economy emissions associated with domestic consumption – form two components of the consumption-based emissions. What remains is to estimate the emissions that are embodied in imports

5 | To estimate emissions that are embodied in imports, we start with the portion of each country's emissions inventory that is exported, as calculated in Step 2 above. Using World Bank data, we distribute each country's exported emissions to each other country on the assumption that the share of the emissions embedded in a country's exports that are received by another country is equal to the share of exports received by that country. We can then sum the imported emissions for each country to get an estimate of the total emissions embedded in imports for each country. This total is pro-rated to cities on a per capita basis.

6 | We add the result of Step 5 to the final consumption emissions and the share of the productive economy emissions associated with domestic consumption to obtain the consumption-based emissions.

References

Consumption-based GHG emissions of C40 cities. C40 Cities (2018). Retrieved from: https://cdn.locomotive.works/sites/5ab410c8a2f42204838f797e/content_entry5ab410fb74c4833febe6c81a/5ad4c0c274c4837def5d3b91/files/C40_GHGE-Report_040518.pdf?1540555698